

8.4 Recommendations for NCA6

While we have assessed NCA5 to be scientifically inadequate and unsuitable as a basis for decision-making, one can imagine a different National Climate Assessment that meets statutory and policy maker requirements. The goal should be not to persuade, but to impart understanding by being objective, transparent and complete. A suitable NCA would be an important complement to IPCC assessments to the extent that its analysis and conclusions differ from the “consensus” of the IPCC reports and additional topics are addressed. Such a report would promote a more open scientific discussion and a more informed policy debate.

We recommend that the NCA6 have a narrower scope than NCA5, refocusing on climate science, including natural climate variability, with topics to include:

- How the climate has changed in the past. The U.S. has the best and longest meteorological records and they should be examined and displayed in their entirety. Trend analyses should include longest periods available and employ suitable statistical methods. Local paleoclimate data should be considered where available. Analysis should demonstrate not only how the climate has varied and changed, but also regional heterogeneity. Standard, easily understandable metrics should be employed.
- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future. A salient example of an acute failure is NCA5 Chapter 26, which fails to mention the historical occurrence and future risk of flash floods in the Texas Hill Country **ROSS MAYBE MENTION WHAT NCA5 SAID ABOUT TX FLOODS in REGIONAL CHAPTER. THEN INCLUDE LINK TO YOUR MINI ANALYSIS**
- A critical survey of current global and regional modeling capabilities and their suitability for regional impact assessments and projections. This would include an assessment of their ability to reproduce observed changes. It should also discuss alternative methods for generating scenario projections on regional and decadal scales, along the lines of Chapter 10 of the IPCC AR6 WGI Report.
- Assessment of the impacts of recent historical climate variability and change on ecosystems and society. Where long-term data indicate a detectable regional change, regional projections can be made for the period 2030-2050. Emissions scenarios exceeding RCP4.5/SSP2-4.5 and ECS values exceeding 4°C should not be used. Regional projections to 2100 have no credibility at this time.

It is important that climate projections be assessed in context of current science capabilities. The pressures toward spatially or temporally precise projections should be resisted as the current models are nowhere up to the task (an example is discussed in CWG25 Section 5.8). In that light, the many pages of NCA5 devoted to projected regional and sectoral impacts have little value.

Given the substantial deficiencies and bias in NCA5 that we have identified, producing an objective NCA6 report with the current NCA organizational construct would be a challenge. A NASEM review could help, but only if the selected participants reflect full viewpoint diversity and do not simply mirror the assumptions and biases of past NCA teams. We regard the CWG25 report to be a good start on NCA6 in terms of scope and objectivity, including adherence to the tenets of Gold Standard Science.

More broadly, we recommend a rewrite of the Global Change Research Act. The current mandate is vague and off point, allowing successive NCA teams to interpret the mandate as they see fit.

Moreover, it is becoming increasingly clear that current and foreseeable models are not fit-for-purpose to describe regional climates, let alone usefully project them for 25 and 100 years. Further, the use of the term “global change” is ambiguous and outdated.

9 REFERENCES

- Aven, Terje (2017) “Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices,” *Reliability Engineering & System Safety* 167 (November 2017): 42–48
<https://www.sciencedirect.com/science/article/pii/S0951832016306950>
- Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.
- Diffenbaugh, N.S., D. Singh, and J.S. Mankin, 2018: Unprecedented climate events: Historical changes, aspirational targets, and national commitments. *Science Advances*, 4 (2), 3354.
<https://doi.org/10.1126/sciadv.aao3354>
- Kirchmeier-Young, M.C. and X. Zhang, 2020: Human influence has intensified extreme precipitation in North America. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (24), 13308-13313. <https://doi.org/10.1073/pnas.1921628117>
- Knutson, Thomas and Fanrong Zeng (2018) “Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends” *Journal of Climate* 31(12) <https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml>
- National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/26757>.
- NCA4. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I* (D. J. Wuebbles, D. W. Fahey, and K. A. Hibbard, Eds.). U.S. Global Change Research Program.
<https://doi.org/10.7930/J0J964J6>
- NCA5. (2023). *Fifth National Climate Assessment* (A. R. Crimmins et al., Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023.CH1>
- Schlund, Manuel, Axel Lauer, Pierre Gentine, Steven C. Sherwood, and Veronika Eyring (2020) Emergent constraints on equilibrium climate sensitivity in CMIP5: do they hold for CMIP6? *Earth System Dynamics* 11 1233-1258 <https://doi.org/10.5194/esd-11-1233-2020>

10 APPENDIX: CHARGE TO THE REVIEW

ABOUT THE AUTHORS

[Insert updated bios]

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/15/2025 11:04:58 PM
To: Ross McKittrick [ross.mckittrick@gmail.com]
CC: John Christy [climateman60@gmail.com]; Steven Koonin [steven.koonin@gmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress
Attachments: NCA5Review Curry SK Curry.docx

Here is my revised version. One proposed change of substance, relates to TX floods.

In section 8.3, i proposed modifying one of the bullets:

- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future. An example of a salient acute failure is the NCA5 chapter (region that includes Texas) that fails to mention the historical occurrence and future risk of flash floods in the Texas Hill Country ROSS MAYBE MENTION WHAT NCA5 SAID ABOUT TX FLOODS in REGIONAL CHAPTER, THEN INCLUDE LINK TO YOUR MINI ANALYSIS

An alternative approach would be to add a new chapter on Failure to document the risk of extreme events based on the historical data base, something like that. Simpler just to mention it in Section 8.3

On Tue, Jul 15, 2025 at 3:33 PM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

If Steve's away until Tuesday a Friday July 18 deadline won't be feasible, so let's work towards a Friday July 25 deadline.

I propose this week we go in the following order to prevent us working on overlapping drafts

Judy goes through the draft tonight

Steve has another look tomorrow.

Then Roy, then John, then me.

On Tue, Jul 15, 2025 at 3:47 PM John Christy <climateman60@gmail.com> wrote:

I like Judy's idea. It's one way to avoid going through the preparation and experience of something like a colonoscopy twice in one month.

John C.

On Tue, Jul 15, 2025 at 2:12 PM Judith Curry <curry.judith@gmail.com> wrote:

Here is a way around the NCA4 issue, propose adding the following text to end of section 8.3

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. However, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability
- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>

Sent: Tuesday, July 15, 2025 1:47 PM

To: Steven Koonin <steven.koonin@gmail.com>

Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

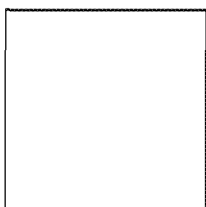
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

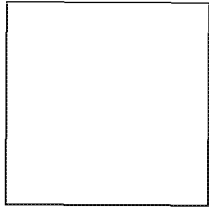
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

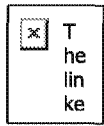


Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

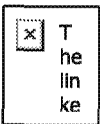
--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

Critique of the Fifth National Climate Assessment

EXECUTIVE SUMMARY	3
1 INTRODUCTION	4
1.1 ABOUT THIS REPORT	4
1.2 ABOUT THE NATIONAL CLIMATE ASSESSMENTS	4
1.3 STANDARDS FOR ASSESSING NCA PRODUCTS	5
1.4 WHEN PEER REVIEW FAILED	ERROR! BOOKMARK NOT DEFINED.
2 NCA5 OVERVIEW CHAPTER: HYPERBOLIC ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE.....	6
3 OVERCONFIDENCE WHEN STATING CONCLUSIONS	7
3.1 INFLATED CERTAINTY LEVELS	7
3.2 OVERSTATING FINDINGS IN UNDERLYING SOURCES	9
3.3 TECHNICAL EXAMPLE: EMERGENT CONSTRAINTS	9
4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS.....	10
4.1 AVERAGE AND EXTREME PRECIPITATION.....	11
4.2 HEATWAVES.....	11
5 INADEQUATE TRACEABLE ACCOUNTS.....	14
6 OVEREMPHASIS ON EXTREME SCENARIOS	16
7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES	18
8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6.....	19
8.1 COMPLIANCE WITH USGCRP'S STATUTORY OBLIGATION	19
8.2 ADHERENCE TO THE TENETS OF GOLD STANDARD SCIENCE	20
8.3 SUITABILITY FOR INFORMING FEDERAL CLIMATE AND ENERGY POLICY	20
8.4 RECOMMENDATIONS FOR NCA6.....	22
9 REFERENCES	23
APPENDICES.....	ERROR! BOOKMARK NOT DEFINED.
APPENDIX 1: CHARGE TO THE REVIEW	24
ABOUT THE AUTHORS.....	25

EXECUTIVE SUMMARY

This report critically evaluates the Fifth National Climate Assessment (NCA5), finding it an inadequate basis for climate and energy policies. A detailed review of the foundational chapters on climate science raises several key concerns:

Scientific Integrity

- An advocacy tone, particularly in the Overview chapter, that is inconsistent with scientific objectivity
- Framing climate policy as a morality play
- Endemic overconfidence when stating conclusions, including inflated certainty levels and overstatement of findings from underlying sources
- No mentions of dissent, disagreement, controversies, or tradeoffs

Flawed methodology

- Minimal discussion of observational inadequacies
- Use of short time periods for trend analyses; lack of a consistent rationale for choosing time scales
- Attribution is implied, not dissected
- Overemphasis on extreme scenarios for future emissions and sea level rise
- Inadequate traceable accounts to support key conclusions

Inadequate Review Process

- A review by the National Academy of Sciences, Engineering, and Medicine (NASEM) failed to identify some fundamental flaws in NCA5
- The NCA5 authors failed to adopt some improvements recommended by NASEM

The report shows NCA5 to be a biased and incomplete picture of climate science that skews toward excessive climate risk. Consequently, NCA5 should not be used as basis for climate and energy policies.

1 INTRODUCTION

1.1 About this Report

This report responds to a request from the Office of Science and Technology Policy (OSTP) Director Michael Kratsios (reproduced in the Appendix) [MAY HAVE TO MODIFY THIS] that we assess the suitability of the Fifth National Climate Assessment (NCA5 2023) for informing climate and energy policies.

To conduct this assessment, we reviewed NCA5 itself, the National Academies of Science, Engineering and Medicine (NASEM) review of the Third Order NCA5 Draft, and the USGCRP responses to that review. We have drawn upon our long experience working on advisory reports, including for the NASEM, the Intergovernmental Panel on Climate Change (IPCC), and other organizations as writers, reviewers, and study leaders.

We find that NCA5 should not be relied on for policy making as it is an incomplete and misleading picture of our understanding of the changing climate and the risks it poses to the nation. NCA5 was selective and incomplete in its survey of climate science. Further, we have reviewed recent scientific developments in a separate report to Energy Secretary Wright (Climate Working Group 2025, herein denoted “CWG25”). The overall effect of the biases and omissions of NCA5 is an excessively dire picture of climate risk.

To support our finding, the following sections of this chapter provide some background on the National Climate Assessments and the standards by which we have assessed NCA5. Chapters 2 through 7 detail important ways in which NCA5 fails to meet those standards. Finally, Chapter 8 summarizes our evaluation of NCA5 and makes recommendations for NCA6.

1.2 About the National Climate Assessments

The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to develop and coordinate “a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.”

The National Climate Assessment (NCA) Reports evolved from the GCRA requirement to:

Prepare and submit to the President and the Congress an assessment which (1) integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings; (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

The five NCA Reports to date have interpreted this mandate in different ways:

- NCA1 (2000) was a multidisciplinary effort to study and portray in regional detail the potential effects of human-induced global warming on the United States.

- NCA2 (2009) was a relatively short report that not only focused on the potential consequences of climate change but also sought to identify potential adaptation measures and identify the highest priorities for future research.
- NCA3 (2014) was an expanded effort that continued along the lines of NCA2, and was distinguished by a comprehensive review process, including a review by the National Academy of Sciences. NCA3 introduced a traceability analysis for each key finding, including a description of uncertainties.
- NCA4 (2017/2018) was a further expanded effort that was published in two volumes: I Climate Science Special Report (CSSR), and II Impacts, Risk, and Adaptation in the United States. This was the first NCA report to devote significant effort to assessing climate science.
- NCA5 (2023) returned to a single volume format, reducing discussion of climate science to a cursory two chapters, with continuing focus on regional and sectoral impacts of climate change. NCA5 expanded its remit to topics that are arguably outside the purview of the USGCRP, focusing on “Climate Action” and policy recommendations with a social justice emphasis.

These successive interpretations of the NCA are poorly aligned with the GCRA’s statutory requirements. Only NCA4 gives serious consideration to climate science, which receives the great majority of USGCRP funding, and even then NCA4 misrepresents some important points. Natural climate variability is essentially dismissed as unimportant in NCA4 and barely mentioned in NCA5 in most contexts, despite the mandate to include both human-caused and natural climate change. Most significantly, NCA5 has redirected the focus away from climate science and even the hazard elements of impacts, towards evaluation of societal vulnerabilities and advocacy for particular policy options, especially deployment of wind and solar power generation.

1.3 Standards for Assessing NCA Products

Beyond the statutory requirements stated above, another pertinent standard is President Trump’s executive order of May 23, 2025, Restoring Gold Standard Science. It enumerates some of the characteristics of good science, namely that it should be:

- i. reproducible;
- ii. transparent;
- iii. communicative of error and uncertainty;
- iv. collaborative and interdisciplinary;
- v. skeptical of its findings and assumptions;
- vi. structured for falsifiability of hypotheses;
- vii. subject to unbiased peer review;
- viii. accepting of negative results as positive outcomes; and
- ix. without conflicts of interest.

For an assessment of policy relevant science, it is also important to include statements about the strength of knowledge. The IPCC’s approach to assessing strength of knowledge is based on judgment of the available evidence and agreement among experts. But there are more sophisticated knowledge characterizations for risk management. Here are the elements according to Aven (2017):

- The degree to which the assumptions made are reasonable/realistic based on background knowledge

- The degree to which data/information exists and are reliable and relevant
- The degree to which there is disagreement among experts (including those from different environments or academic fields)
- The degree to which the phenomena involved are understood and accurate models exist
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns (issues that are known to matter but are ignored, such as, in this context, natural variability).

2 NCA5 OVERVIEW CHAPTER: ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE

NCA5 Chapter 1, “Overview”, holds a prominent place in the Report since it summarizes the entire report and is the only section that many will read. Chapter 1 is marred by an activist tone, language that aggressively promotes mitigation policies, and motivated optimism. As such, this chapter adds an imprimatur of scientific authority to naïve and simplistic declarations of opinion about public policy. Here are some examples.

Chapter 1 opens with:

The more the planet warms, the greater the impacts. Without rapid and deep reductions in global greenhouse gas emissions from human activities, the risks of accelerating sea level rise, intensifying extreme weather, and other harmful climate impacts will continue to grow. Each additional increment of warming is expected to lead to more damage and greater economic losses compared to previous increments of warming, while the risk of catastrophic or unforeseen consequences also increases.

This statement presupposes that all warming is anthropogenic, that all warming is bad and causes economic damage, and that warming intensifies extreme weather. Such sweeping generalizations go well beyond what science has or can establish. The statement also refers to growing risks without reference to their magnitude – a small risk that increases might still be a small risk, and a large risk might be only incrementally worsened.

On the next page one finds:

Each additional increment of warming leads to greater risks [here it lists 7 key components of society including food security and the economy] ... Without deeper cuts in global net emissions, climate risks to the US will continue to grow... Action to limit future warming and reduce risks can have near-term benefits and opportunities: low-carbon energy jobs, Improved air quality, Health benefits, Economic benefits...”

The authors write as if climate policy does not involve trade-offs and all measures to reduce future warming will be effective and beneficial. Neither the vast body of scholarship on climate science and economics nor historical experience support such simplistic claims (CWG25). Not every additional increment of warming leads to economic harms; in fact, NCA5 Chapter 19 acknowledges that there will also be benefits. Nor is climate policy guaranteed to benefit the economy; it could impose net costs. Such misleading statements are a disservice to policymakers.

Pages 8 and 9 of the Overview promote renewable energy options by noting, correctly, that the levelized costs of wind/solar generation have fallen sharply since 2010, and so offers this rationale for pursuing deep emission reductions:

Recent growth in the capacities of wind, solar, and battery storage technologies is supported by rapidly falling costs of zero- and low-carbon energy technologies, which can support even deeper emissions reductions. For example, wind and solar energy costs dropped 70% and 90%, respectively, over the last decade, while 80% of new generation capacity in 2020 came from renewable sources.

Yet it has long been known that intermittent renewables generation must be supplemented by dispatchable generation to meet grid reliability standards, and that doing so (*e.g.*, through natural gas, fission, or storage) significantly increases the total cost of electricity. Further, there are yet unmet synchronization challenges in electrical grids with heavy penetration of wind and solar generation. NCA5 fails to acknowledge these facts. But more importantly, we see no reason for NCA5 to be discussing renewable energy technologies and economics in the context of its mandate.

Page 17 of the Overview introduces the discussion of risks from extreme weather events by saying “Harmful impacts from more frequent and severe extremes are increasing across the country.” This creates the impression that extreme weather events are worsening and that disaster losses are driven by trends in extreme weather. While the section goes on to acknowledge that some of the increase is due to increases in the exposure and value of assets at risk, it then invokes the NOAA Billion Dollar Dataset as evidence of extreme weather getting worse. Scientists have shown that this is an invalid metric (CWG25 Section 10.2) since it measures the growth of the economy not the frequency of extreme weather, and indeed NOAA has recently withdrawn the data product. Even though the dataset was still distributed by NOAA at the time of the NCA5, the report authors failed to assess it skeptically and see that it was unfit for the purpose of measuring climate trends.

Page 23 of the Overview states, in large font:

Climate changes are making it harder to maintain safe homes and healthy families; reliable public services; a sustainable economy; thriving ecosystems, cultures, and traditions; and strong communities.

This statement cannot be evaluated on scholarly grounds and so doesn’t belong in a scientific assessment report. Its prominent inclusion points not only to the willingness of NCA5 authors to promote alarm, but also the ineffectiveness of the review process in eliminating such statements.

3 OVERCONFIDENCE WHEN STATING CONCLUSIONS

3.1 Inflated certainty levels

Overconfidence in stating conclusions has been an endemic problem in NCA Reports. The authors frequently make sweeping generalizations without appropriate caveats or acknowledging uncertainties. The overconfidence begins with inflated language to describe certainty levels.

NCA5 uses specific terms to convey information about scientific confidence associated with important finds, observations and projections. The Front Matter of NCA5 states that

confidence in a finding is based on the type, amount, quality, strength, and consistency of evidence; the skill, range, and consistency of methods to detect, evaluate, attribute, and interpret climate trends; and the degree of agreement across scientific information sources.

Table 1 from the Front Matter provides calibrated language for confidence assessment:

Very high:	Strong evidence (established theory, multiple sources, well documented and accepted methods, etc.). High consensus
High:	Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.). Medium consensus
Medium:	Suggestive evidence (a few sources, limited consistency, methods emerging, etc.) Competing schools of thought.
Low:	Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.). Disagreement or lack of opinions among experts.

This terminology is obviously inflated: *high confidence* with just moderate evidence and medium consensus; *medium confidence* with only suggestive evidence and competing schools of thought. This inflation in terminology leads to overconfidence in conclusions.

Even with this inflated terminology, NCA5 further inflates the confidence level of many of its conclusions to well beyond what the IPCC has concluded with more thorough justification, and by incorrectly applying its own standards. An example is the conclusion about anthropogenic influence on climate change, arguably one of the most important scientific statements of the report.

Key Message 3.1 Traceable Account states:

There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have unequivocally caused *all* global warming observed over the industrial era.

while the corresponding statements from IPCC AR5 and AR6 are

AR5: It is *extremely likely* that *more than half* of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. (IPCC, 2013)

AR6: The *likely* range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C. It is *likely* that well-mixed GHGs contributed a warming of 1.0°C to 2.0°C, other human drivers (principally aerosols) contributed a cooling of 0.0°C to 0.8°C, natural drivers changed global surface temperature by –0.1°C to +0.1°C, and internal variability changed it by –0.2°C to +0.2°C. It is *very likely* that well-mixed GHGs were the main driver of tropospheric warming since 1979.

The IPCC AR5 and AR6 statements provide likelihood assessments but not a confidence level. While NCA5 claims with *very high confidence* that fossil fuels have unequivocally caused *all* global warming, AR5 refers to “*more than half* of the observed warming” and AR6 provides a more nuanced statement that relates to a *likely* range of warming contributed to by human drivers.

3.2 Overstating findings in underlying sources

Although we did not do a detailed audit of NCA5's use of source material, spot checks suggest a pattern of overstatement.

Chapter 2 page 11 reports on an increase in precipitation in some areas and attributes it to "climate change":

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

NCA5 attributes the claim to Knutson and Zeng (2018). But Knutson and Zeng did not say these things nor did they analyze this particular period. For 1981-2010 they cautioned that observed changes are consistent with natural variability, and they did not claim attributable trends were observed over the United States.

As another example of overstating findings, NCA5's Chapter 2 page 18 states

There is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US.

This is apparently attributed to Diffenbaugh *et al.* (2018) and Kirchmeier-Young and Zhang (2020). Diffenbaugh *et al.* presented ratios of observed occurrences of extreme events to simulated occurrence rates in CMIP6 models run with only natural forcings. They report that for 79% of the U.S., extreme rainfall events are currently more frequent than in simulations, and the ratio of occurrences will rise under future warming simulations. This is not "robust" evidence of anthropogenic influence since it requires readers to assume that climate models accurately simulate regional precipitation patterns, something that the IPCC AR6 states is uncertain (AR6 WGI SPM Box SPM 1.2, SPM Section C.1.3).

Kirchmeier-Young and Zhang used three global climate models to analyze extreme 1- and 5-day events in North America. They noted large differences among the three models in their simulated precipitation changes, and two of the three models failed to yield attribution for 5-day events for the North America mean.[DON'T UNDERSTAND THIS PHRASE] THIS IS CLEAR, KEEP AS IS In other words, the models disagreed on whether the observed changes were anthropogenic. Both of the cited references utilized the implausible RCP8.5 scenario (Chapter 6 of this report) and began their historical observational records only in 1961. Here again this is not "robust" evidence. It is merely suggestive, particularly since other studies have found natural variability to be predominant.

3.3 Example: Emergent constraints

Some of the overconfidence expressed by NCA5 arises by omitting discussion of counterevidence in the peer reviewed literature, ignoring dissent and disagreement. An example is the topic of "emergent constraints". NCA5 Chapter 3 page 17 invokes this concept to support its claim that key uncertainties in climate model projections have been reduced:

An approach to reduce uncertainty in climate change projections has matured over the past decade. It is known as "emergent constraints." The term refers to strong statistical relationships between highly uncertain future climate parameters and observable trends or variations in the current climate, along with a physical explanation of this relationship.

Emergent constraints appeared in the climate modeling literature as an attempt to tie climate model behavior to climate observations in hopes of generating insight into real-world equilibrium climate sensitivity (ECS). Climate models exhibit a wide range of ECS values. The idea of emergent constraints is to examine whether the models with shared sensitivity values also share a common representation of some climate process (usually related to clouds) that might influence ECS. Suppose, for example, that in low-ECS models the total cloud fraction in the tropics is strongly correlated with that in the southern midlatitudes, but in high-ECS models the correlation is weak. Then researchers could examine whether the observed correlation is strong or weak and draw a conclusion about which type of model, and therefore which ECS value, is more likely.

A problem in the emergent constraint literature is that there has been a proliferation of proposed correlations with little physical motivation. NCA5 alludes to this in the Traceable Accounts section (p. 3-40) but not in the main chapter text. As shown by Schlund *et al.* (2020), many emergent constraints patterned on CMIP5 models (Coupled Model Intercomparison Project No. 5, used for the IPCC 5th Assessment Report) failed to work on CMIP6 models (used for the IPCC 6th Assessment Report). In other words, the correlations between ECS and cloud processes present in CMIP5 models were absent in CMIP6 models, indicating that they were likely spurious rather than clues to physical processes governing the climate system. As a result, emergent constraints estimated on CMIP5 models *increased* the uncertainty of ECS, rather than decreasing it as claimed by NCA5.

Yet NCA5 described the use of emergent constraint analysis as an advance that reduced the uncertainty of ECS and climate model projections (p. 3-38):

Emergent constraints have been widely applied to reduce the simulated spread in the climate feedbacks that shape climate sensitivity.

4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS

CWG25 Chapter 6 discussed the need for care in the choice of time scale when making claims about trends in extreme weather. We provided examples from analysis of river flooding, heatwaves, and extreme precipitation to show how assertions about apparent trends based on short data sets fall apart when considering longer versions of the same data sets. NCA5 uses varying time periods for trend analyses, especially in Chapter 2 (which is focused on trends), without explaining why shorter or longer intervals were chosen. For example, page 2-4 defines temperature trends with respect to the interval since the late 1800s whereas page 3-29 presents temperature trends over 1972-2021. Page 2-11 compares rainfall over the 2002-21 versus 1901-1960 intervals while page 2-18 uses the interval since the late 1950s to compute trends.

A further problem is that NCA5 uses the term "trend" repeatedly without indicating if it is statistically significant (*i.e.*, distinguishable from random variability); the ambiguity creates the impression all the observed changes were significant, but readers are left to speculate. All climate variables will, in principle, drift up or down over any particular time interval. Identifying the change as a trend requires showing that it is statistically significant using a variance estimator suitable for the type of

data being analysed. Of particular importance is choosing a method robust to the serial correlation that is frequently present in climate data. Throughout Chapters 1 to 3, references are made to “trends” without explaining how they were computed. The exception was on page 1-19 which refers to urban temperature trends being calculated using the Theil-Sen estimator, although that method does not seem to have been used elsewhere. The one case where reference is made to statistical significance is on Page 2-9 referring to a trend in Atmospheric Optical Depth, but no explanation is given of how significance was determined. Page 2-19 refers to regional trends in droughts being “robust” but again fails to explain how the term was defined.

4.1 Average and Extreme Precipitation

CWG25 Section 6.4 we presented analyses of updated data for the same locations [SAME AS WHAT?] (and many others), in all cases finding both considerable regional heterogeneity and that trends detectable on one time scale are often not detected on longer or shorter time scales. These findings argue against simple attribution of changes to anthropogenic influences. In this section, when we refer to calculation of trends in precipitation, we use ordinary least squares to compute the linear trend over the entire sample length and we use the Vogelsang and Franses (2007) variance estimator which is robust to general forms of serial correlation. IS THIS STATEMENT NEEDED?

NCA5 did not continue the NCA4 precedent of using the post-1901 interval as the time scale for its precipitation discussion. Instead, it refers to changes “since the 1950s”; NCA5 Figure 2.8 suggests 1958 might be the intended start date. Under Key Message 2.2, “Extreme Events Are Becoming More Frequent and Severe”, NCA5 states (p. 2-18):

Rainfall is becoming more extreme
Since the 1950s, there has been an upward trend in heavy precipitation across the contiguous US. This increase is driven largely by more frequent precipitation extremes, with relatively smaller changes in their intensity.

In addition to our concerns that inferences about trends are contingent on choice of time scale, if the intended meaning of this statement is that positive and significant trends are found in heavy precipitation events across CONUS, we cannot reproduce it. Details of our analysis can be found at [LINK TO BRIEF WRITEUP ON THIS](#) can we just reference CWG HERE

Based upon our analysis, the following is a more accurate summary of what U.S. precipitation data show.

There are regionally heterogeneous changes in average and extreme precipitation. Positive trends in annual average rainfall and extreme events (defined either as the annual maximum or the number of exceedances of the 99th percentile value) are generally weak or non-existent when looking at samples exceeding 130 years in length. Significant trends can be found when beginning the sample in the 1950s although in most cases the trends weaken and become insignificant when looking at the post-1980 interval. This argues against attribution of changes in precipitation to anthropogenic warming.

4.2 Heatwaves

In contrast to NCA5, NCA4 examined heat extremes across the entire 20th century, pointing out that peak heat wave activity was reached in the 1930s and has decreased since then, and that recent increases are confined to areas west of the Rockies. NCA4 stated:

[The] warmest daily temperature of the year increased in some parts of the West over the past century, but there were decreases in almost all locations east of the Rocky Mountains. In fact, all eastern regions experienced a net decrease, most notably the Midwest (about 2.2°F [1.2°C]) and the Southeast (roughly 1.5°F [0.8°C]).

Since the mid-1960s, there has been only a very slight increase in the warmest daily temperature of the year (amidst large interannual variability). Heat waves (6-day periods with a maximum temperature above the 90th percentile for 1961–1990) increased in frequency until the mid-1930s, became considerably less common through the mid-1960s, and increased in frequency again thereafter. As with warm daily temperatures, heat wave magnitude reached a maximum in the 1930s. (NCA4 pp. 190-191)

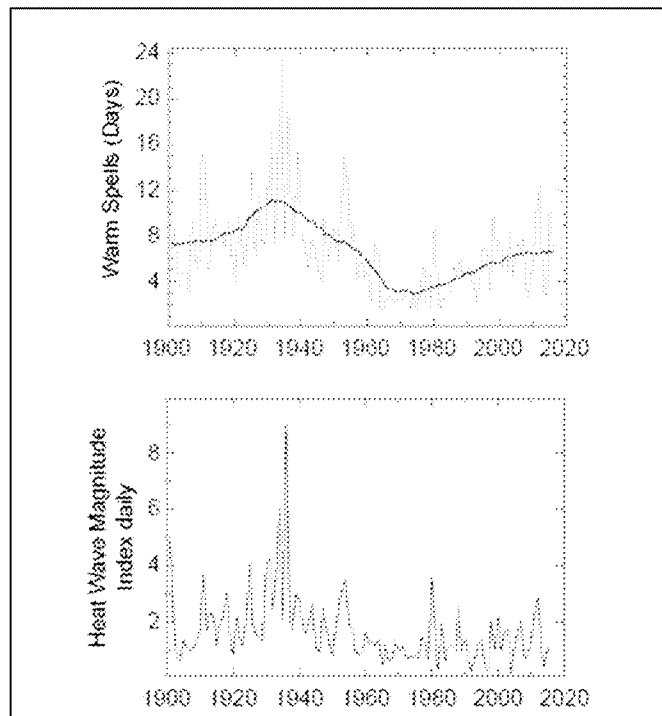


FIGURE 3. U.S. Heat waves since 1900. Reproduction of NCA4 Figure 6.4

Contrast this careful and factual language from NCA4 with NCA5 Key Message 2.2: “Extreme Events Are Becoming More Frequent and Severe.” This blanket statement is followed by NCA5 Figure 2.7 (reproduced as Figure 4 below) which shows the number of hot days, cold days and warm nights (respectively in panels a—c) over the period 2002-2021 compared to 1901-1960. [Presumably these are annual counts, although not stated in the caption.]

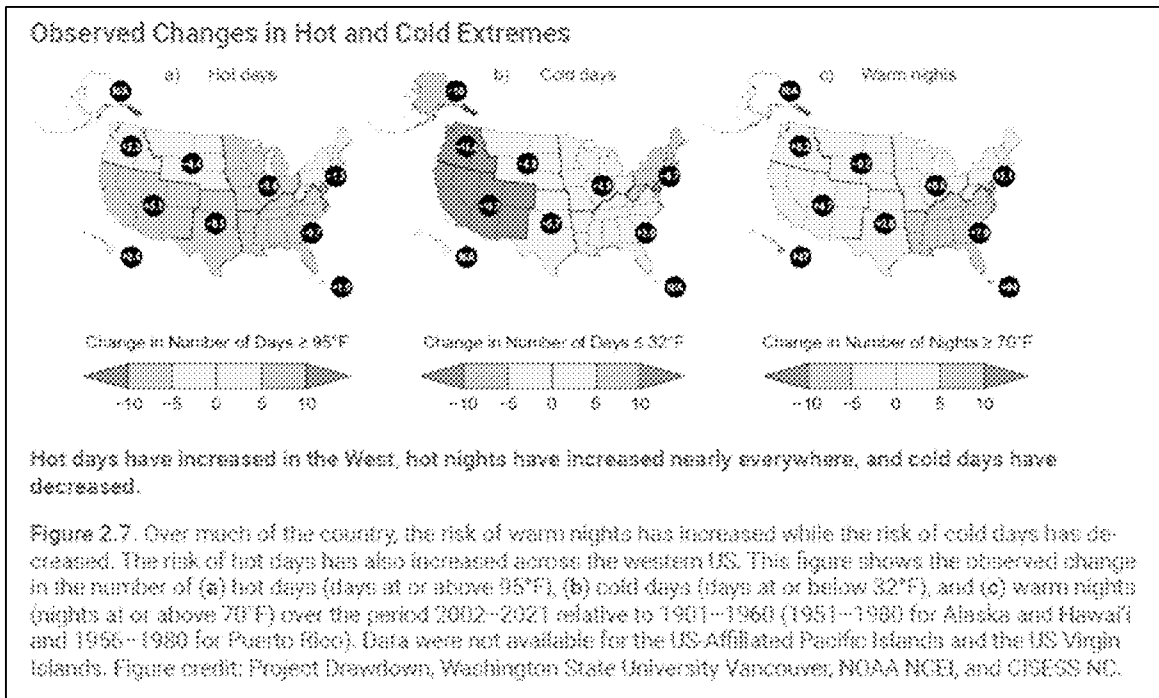


FIGURE 4: Reproduction of NCA5 Figure 2.7.

Close inspection shows that this figure actually contradicts the NCA5 Key Message with respect to heatwaves and instead reinforces the position of NCA4. Notwithstanding Key Message 2.2, the leftmost panel in NCA5 Figure 2.7 above shows that over most of CONUS the number of extreme heat days has *decreased* in recent decades compared to the prior century.

The accompanying discussion in NCA5 becomes convoluted as it appears to be aimed at supporting the Key Message despite the contrary evidence. NCA5 Chapter 2 elaborates on Key Message 2.2 by stating (page 2-16):

Observations show an increase in the severity, extent, and/or frequency of multiple types of extreme events. Heatwaves have become more common and severe in the West since the 1980s (*high confidence*).

But while it mentions the increase in hot days in the West, it fails to mention the decrease everywhere east of the Rockies. On the next page (page 2-17) it raises the comparison to the 1930s and then switches to discussing global counts:

By some measures, the most extreme heatwaves on record in the United States occurred during the Dust Bowl era of the 1930s. ... Globally such heatwaves are becoming more frequent, and in recent decades the western United States has been following those trends.

The reference to a global trend seems to be an attempt to tie heatwaves to anthropogenic climate change. But the obvious question, unaddressed by NCA5, is why one region follows the global pattern of increasing heatwaves while most of the country is trending in the opposite direction. These issues are addressed in Chapter 6 of CWG25, demonstrating that the range and magnitude of extreme temperatures are driven more by natural variability than by anthropogenic forcing. The analysis in CWG25 shows that for both (a) hot days ($\geq 95^\circ\text{F}$) and (b) number of days in heatwaves, the current decade is no hotter than a century ago in the U.S. Thus, the NCA5 claim that “multiday heatwaves

have become hotter, more frequent, larger, and longer lasting in recent decades,” is simply false when expanding the temporal and spatial domains to encompass all available data (Chapter 6 and Figure 6.3.6 of CWG25).

NCA5 then pointed to the dramatic Pacific Northwest heatwave of 2021. CWG2025 Section 8.6.1 discusses this event in detail, reviewing the multiple peer reviewed studies that explained the unusual meteorological context was unrelated to human-caused climate change, a point omitted from the NCA5 discussion.

NCA5 finally addresses the declining heatwave trend in CONUS east of the Rockies but attempts to reframe it by focusing on urban warm spells.

[The] number of very hot days has actually decreased across the central and eastern regions due to summer cooling trends in the region (Figure 2.7; Ch. 22). This does not, however, mean the central and eastern US are not affected by heat. The impacts of extreme high temperatures are more severe if such conditions persist for several days, and overall, multiday heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades. Across 50 large US cities, the US Global Change Research Program heatwave indicator (<https://www.globalchange.gov/indicators/heat-waves>) shows that the average number of heatwaves has doubled since the 1980s, and the length of the heatwave season has increased from about 40 days to about 70 days.

We discussed this part of NCA5 in CWG25 Section 6.3. The figure referenced by NCA5 uses a short time period which begins in the 1960s, the coldest decade in the last 100 years, thus suppressing any comparison to the 1930s. Further, nighttime temperatures in urban areas have increased faster than daytime temperatures (which NCA5 acknowledges), but this is a signature of urban heat islands and not a good metric of climate change. CWG25 found that the occurrence of hot days ($\geq 95^{\circ}$ F) has recently increased in the West, but declined since 1899 in the remainder of the country and in the nationwide average.

5 INADEQUATE TRACEABLE ACCOUNTS

NCA3 began the practice of including a section on Traceable Accounts at the end of each chapter. This is the description from NCA5:

Each chapter concludes with a section entitled Traceable Accounts, which provides information on the overall process used to develop the chapter as well as a separate Traceable Account section for each Key Message. These Traceable Accounts describe the supporting evidence behind each Key Message, the process and rationale authors used in reaching their conclusions, and the author team’s expert assessment of the confidence in and, where applicable, likelihood of these conclusions. As such, Traceable Accounts provide information about the state of the science, document sources of uncertainty, identify research gaps, and allow traceability to data and resources.

The Traceable Accounts for each Key Message includes the following sections:

- Description of Evidence Base
- Major Uncertainties and Research Gaps

- Description of Confidence and Likelihood

The Traceable Accounts could have addressed the statutory requirement that the NCA discuss scientific uncertainties. They could also help satisfy the Executive Order for Restoring Gold Standard Science by addressing reproducibility, transparency, communication of error and uncertainty, and skepticism of findings and assumptions. However, the Traceable Accounts in NCA5's Chapters 2 and 3 are uneven, often superficial and uninformative.

An example of a deficient Traceable Account is NCA5's Key Message 2.2: "Extreme Events are Becoming More Frequent and Severe". The "Description of the Evidence Base" offers two paragraphs, the first summarizing the findings and the second generically describing the types of data that can be used for storms. "Major Uncertainties and Research Gaps" focuses on the uneven distribution across U.S. populations due to differences in exposure and vulnerability. The only limitations in data referred to are the lack of a long-term record of lightning and the lack of homogenized daily and hourly temperature data apart from reanalysis products.

But the most astonishing deficiency is in the "Description of Confidence and Likelihood." One of the statements in Key Message 2.2 is:

Hurricanes have been intensifying more rapidly since the 1980s (*high confidence*) and causing heavier rainfall and higher storm surges (*high confidence*).

The Description of Confidence and Likelihood includes the following statement:

Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why the authors also have high confidence that storms are delivering more rainfall and high confidence that storm surges are becoming higher.

No reference to journal publications or a specific data set is made anywhere in the chapter regarding hurricane-induced precipitation or storm surge to support this *high confidence* conclusion.

The Traceable Accounts for the various Key Findings of Chapter 3 have some substantial inconsistencies. Consider

Key Message 3-1: Human activities have caused global warming.

Confidence and Likelihood: "There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have *unequivocally* caused all global warming observed over the industrial era. There is also *very high confidence* that changes in natural climate drivers have had globally small and regionally variable long-term effects over this period."

The Uncertainties section addresses only uncertainties in radiative forcing by greenhouse gases, ignoring the great uncertainty in model response (CWG25 Chapters 4 and 5) In contrast, the Traceability Analysis of Key Message 3-4 ("Humans Are Changing Earth System Processes") raises the problem that relatively little is known about the role of natural variability at the regional scale. From its Description of Evidence Base:

In the last decade, there has been increasing recognition of the role of regional-scale natural variability in the past and future evolution of climate, as well as the fact that regional natural variability signals can be competitive with forced anthropogenic signals.

And from its Major Uncertainties and Research Gaps:

For example, the true natural variability of the climate system on decadal to centennial timescales could be larger than what we estimate from GCMs, which would further increase the irreducible uncertainty stemming from natural variability.

These statements are among the most scientifically credible in the entire NCA5 and they directly undercut the confidence assigned to Key Message 3-1.

There is also a generic problem in tracing NCA5's Traceable Accounts. The Front Matter of NCA5 states:

Each figure and some tables are accompanied by a metadata survey, which can be accessed in the online version of the report by clicking on the eyeball icon above the figure or table (see the table below for explanations of additional icons used throughout the report). The metadata survey describes data sources, figure or table development methods, copyright information, and other important documentation.

Clicking on the 'eyeball' icon does not reveal the metadata information; instead a "Contact Us" email appears, addressed to the USGCRP. This is an inadequate way to archive the metadata information.

In summary, the Traceable Analyses examined here, with few exceptions, fail to meet the stated objectives of the NCA.

6 OVEREMPHASIS ON EXTREME SCENARIOS

To respond to the GCRA mandate to "project major trends for the subsequent 25 to 100 years," NCA5 relies on projections of future climate change based on estimates of future emissions (the so-called SSP scenarios) and/or specified levels of radiative forcing (the RCP scenarios). For the most part, NCA5 uses scenarios developed for the IPCC Assessment Reports.

CWG25 Section 3.2.1 presented a critical assessment of past and current IPCC scenario envelopes, showing that they have tended to overshoot observed emissions. IPCC AR6 published in 2021 stated that "The likelihood of high-emission scenarios like RCP8.5 and SSP5-8.5 is considered low in light of recent energy sector developments." and that same year UN Climate Negotiators (COP) stopped using scenarios above 4.5.

NCA5 makes the following observations about the scenarios they use:

NCA5 authors were advised to assess the full range of scenarios available. (Front Matter)

Scenarios of future emissions and land-use change are developed as plausible alternatives, but no relative likelihood is attached to them. Some recent studies, however, have argued that

the highest scenario, SSP5-8.5, is no longer plausible without a reversal of current trends in the adoption of renewables and energy efficiency. (Key Message 3.3 Traceable Analysis)

Despite acknowledging the issue, NCA5 otherwise ignored the problem. A keyword search of NCA5 of mentions of RCP/SSP scenarios finds over 50% referred to the extreme emissions scenarios RCP8.5/SSP5-8.5. Further, nine NCA5 figures (5.2, 6.9, 7.4, 11.3, 14.6, 22.13, 22.19, 27.9, 29.13) included *only* the 8.5 scenarios.

The problem of relying on extreme scenarios is particularly acute for NCA5's sea level rise projections. The sea level rise scenarios used in NCA5 do not relate directly to the SSP emissions scenarios, but rather to specified amounts of sea level rise by 2100. Table 4 of NCA5's "Guide to Using this Report" reproduced below shows that Low relates to 0.3 m (0.98 feet), Intermediate-Low relates to 0.5 m (1.64 feet), Intermediate relates to 1.0 m (3.28 feet), Intermediate-High relates to 1.5 m (4.92 feet), and High relates to 2.0 m (6.56 feet).

Table 4. Descriptive Terms for Common Sea Level Rise Scenarios Used in NCA5						
Future global mean sea level rise and sea level rise along United States coastline are shown for five scenarios in feet (and meters), relative to a 2000 baseline. The US values shown in the right half of the table are averaged across the US coastal regions, including the contiguous US, Alaska, Hawaii, and the US-Affiliated Pacific Islands, and the US Caribbean. The national values shown in the table differ substantially from regional values. For example, sea level rise is higher in the Gulf Coast and lower or even negative in some parts of Alaska. In the next 30 years (2020–2050), sea level along the contiguous US coasts is expected to rise 0.92 feet (0.28 m), the same amount of sea level rise observed over the last 100 years (1920–2020). See Chapter 9 for regional sea level information. Adapted from Sweet et al. 2022.”						
Sea Level Rise Scenario Descriptor	Global Mean Sea Level			United States		
Year	2050	2100	2150	2050	2100	2150
Low	0.49 (0.15)	0.98 (0.3)	1.31 (0.4)	0.59 (0.18)	0.98 (0.3)	1.64 (0.5)
Intermediate-Low	0.66 (0.20)	1.64 (0.5)	2.62 (0.8)	0.75 (0.23)	1.64 (0.5)	2.95 (0.9)
Intermediate	0.92 (0.28)	3.28 (1.0)	6.23 (1.9)	0.89 (0.27)	3.28 (1.0)	6.89 (2.1)
Intermediate-High	1.21 (0.37)	4.92 (1.5)	8.86 (2.7)	1.12 (0.34)	4.92 (1.5)	8.86 (2.7)
High	1.41 (0.43)	6.56 (2.0)	12.14 (3.7)	1.38 (0.42)	6.56 (2.0)	12.46 (3.8)

TABLE 1: Reproduction of Table 4 from the Front Matter of NCA5

Considering only projections representing processes quantified with at least medium confidence, IPCC AR6 assessed global mean sea level projections for all emissions scenarios (including implausible extreme emissions scenarios) for 2100 to fall between 0.2 and 1.6 m (5th—95th percentile range). Nevertheless, the range of sea level rise scenarios considered by NCA5 extends to 2.0 m. Further, NCA5 fails to include plausible lower scenarios, such as 0.2 m cited by the IPCC, which also corresponds to the average rate of sea level rise over the past century.

Chapter 9 of NCA5 offers the following predictions of sea level rise:

“Under a range of potential global warming levels, average sea level along US coastlines is *likely* to be between 12 and 20 inches above 2000 sea levels in 2050 (Figure 9.2).”

The projected sea level rise values span from the Intermediate scenario to values slightly greater than the High scenario. They can be put into context by considering the observed global sea level rise from 2000-2024, which is only approximately 3.4 inches (0.28 feet). NCA5 is thus projecting a sea level rise during 2025 and 2050 that is 3.5 to 5.8 times the rate observed during 2000-2024, an exceedingly implausible outcome. Chapter 9 further states:

“Looking toward the future, an 11 inch (28 cm) average rise along the contiguous US coastline is expected by 2050 (relative to 2020), with a *likely* range of 9-13 inches.”

...

“There is *high confidence* and it is *likely* that sea levels will rise about 11 inches (likely range of about 9–13 inches) between 2020 and 2050”

In summary, NCA5 presents future sea level rise scenarios that are not directly relatable to either SSP/RCP emissions scenarios or to plausible global warming levels. The NCA5 scenarios include two that are higher than the 95th percentile for the extreme emissions scenario RCP8.5 and include hypothesized ice sheet processes in which there is low confidence. Projections to 2050 require rates of sea level rise from 2025 to 2050 that are more than triple the rate observed during 2000-2024. Further, NCA5 ascribes *high confidence* to these sea level rise projections. CWG25 Section 7.3 provides further context for USGCRP projections of extraordinary sea level rise in the next 25 years.

More generally, NCA5’s inclusion of, and even focus on, implausible extreme scenarios supports projections of alarming impacts that are very unlikely to be driven by anthropogenic warming.

7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES

NCA5’s Glossary defines “climate change” as a change in climate for any reason. This is technically correct, but at variance with the (now) popular perception of all climate changes being anthropogenic. The distinction is not academic- it is central both to attribution questions and to projections, since anthropogenic changes would respond to mitigation, while natural changes are unavoidable.

The discussion on NCA5 page 2-4 begins “Human activities are changing the climate”, then goes on to list evidence for anthropogenic GHG emissions and climate warming. The next paragraph begins “Climate change is happening now in the United States. Including Alaska, the continental US has been warming about 60% faster than the planet as a whole since 1970.” The implication is that the warming of CONUS faster than the planetary average is an effect of GHG emissions. But it is an artifact of the Earth’s surface being 70 percent ocean. Since the ocean warms more slowly than land, comparison of any land surface outside the tropics with the global average would show the land surface to be warming faster than the global average, regardless of the cause of the warming.

The same page goes on to say “Climate change is already affecting people in the United States. Extreme heat was estimated to be responsible for more than 700 deaths per year between 2004 and 2018 although some estimates put heat-related mortality closer to 1,300 deaths annually.” But extreme heat, whether natural or not, has always been a risk to human health. As to trends, the data show that adaptation has caused the mortality burden of extreme heat to drop substantially in recent decades (CWG25 Section 10.3.1).

Consider also the NCA5 statement on precipitation cited in Section 3.2:

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

The attribution is superfluous because the statement is a tautology by NCA5's definition of climate change. But its gratuitous inclusion effectively attributes the observed trend to greenhouse gas emissions.

Exploitation of the ambiguity in "climate change" is endemic to NCA5. The NASEM review (pp. 23-24) commented on this problem as follows:

The draft NCA5 report frequently describes "change" but does not consistently distinguish between natural variability and climate change. This lack of clarity can be misleading for the reader by creating the misconception that some impacts that are the result of the combination of natural variability and climate change are instead solely due to climate change... it is important for NCA5 authors to accurately identify the multiple drivers of change (including global change), in addition to climate change, and accurately attribute impacts. Clearly describing impacts due to natural variability, climate change, or a combination of the two is important not only for informing policy decisions, but also for building public understand and trust in the report's messages. Climate change and natural variability should be clearly defined in the glossary and natural variability could be introduced in chapter introductions when the concept is important for understanding key messages.

This could have been easily addressed, for example by reserving the term "climate change" for anthropogenic changes and using "climate variability" for natural changes. But the NCA5 authors seemingly ignored their recommendation.

A separate but related issue is use of the term "climate change" to refer to increases in socioeconomic vulnerabilities that have anthropogenic but non-GHG-related causes. NCA5 page 1-19 states "Climate change exacerbates inequalities." But the issue discussed is the negative correlation between neighborhood-level income and land surface temperatures in urban areas. To the extent the correlation is real, the most likely explanation is that low-income households concentrate where housing is less expensive, which may be in neighborhoods with less nearby parkland and tree cover, which has nothing to do with CO₂ emissions.

8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6

This chapter summarizes our evaluation of NCA5 relative to OSTP's charge: whether NCA5 (1) complied with the USGCRP's statutory obligation; (2) adheres to the core tenets of Gold Standard Science; and (3) can suitably inform federal climate and energy policy. The points made in this summary analysis refer to specific sections of this report as well as to the CWG25 report.

8.1 Compliance with USGCRP's statutory obligation

As cited in Section 1.2 of this report, the Global Change Research Act requires an assessment that:

- (1) integrates, evaluates, and interprets the findings of the [Global Change Research] Program and discusses the scientific uncertainties associated with such findings;

- (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

We deem NCA5 to have fallen short when evaluated against these criteria because of the following major shortcomings (each is detailed in the chapters cited):

- Inadequate assessment of the relevant topics in climate science and the hazard components of climate impacts (such as hurricanes and floods). NCA5 instead focuses on evaluation of societal vulnerabilities (such as flood infrastructure, access to air conditioning, etc.), “Climate Action,” and policy recommendations with a social justice emphasis (Section 1.2).
- Overconfidence in conclusions and inadequate assessment of uncertainties (Section 3.1.5)
- Inadequate discrimination between natural and human-induced causes of trends and impacts (Chapter 7)
- Inadequate analysis of climate trends by relying on short time periods (Chapter 6)
- Uncritical evaluation of emission scenarios and climate model simulations in making projections for the next 25 to 100 years (Chapter 6; Section 3.2.1 and Chapter 5 of CWG25).

8.2 Adherence to the tenets of Gold Standard Science

With respect to the tenets of Gold Standard science listed in Section 1.2 of this report, we have identified the following major shortcomings in NCA5:

- **Lack of reproducibility.** In the few examples that we examined closely, we identified an instance where we could not reproduce the findings of the NCA5, a task that should require only rudimentary data analysis (Section 4.1)
- **Lack of transparency.** In many instances, the Traceable Account fails to justify the Key Finding. Metadata was not readily accessible. (Chapter 5)
- **Inadequate communication of error and uncertainty.** The Traceable Account for each Key Message provides a section on Major Uncertainties and Research Gaps; most of the accounts that we examined were superficial and uninformative. (Chapter 5)
- **Not skeptical of findings and assumptions.** The main text of the chapters is, with few exceptions, not skeptical of its findings and assumptions and does not mention dissent or disagreement. (Chapters 3 and 5)
- **Some hypotheses and Key Messages are not falsifiable.** Key Message 13.4 is but one of many examples: “Equitable Distribution of Transportation Trade-offs and Benefits Requires Community Involvement.”
- **Failure to acknowledge benefits** of warming and additional atmospheric CO₂ (CWG25 Section 2.1, Chapter 9)
- **Inadequacy of the peer review process.** The review of the NCA5 Third Order Draft by National Academies of Science, Engineering and Medicine (NASEM) identified some of the deficiencies we have noted, but the NCA5 authors were not obligated to adopt the NASEM recommendations. More importantly, we’ve identified many other deficiencies in NCA5; the NASEM review did not point them out and thus lacked the rigor expected of NASEM reports.

8.3 Suitability for informing Federal climate and energy policy

We assess that the selection and presentation of information in NCA5 makes it an unreliable basis for U.S. climate and energy policy making. For each of the elements of knowledge characterization suitable for risk management listed in Section 1.3, here are specific examples where NCA5 falls short:

- The degree to which the assumptions made are reasonable/realistic based on background knowledge
 - NCA5 focused on implausibly extreme scenarios for emissions and sea level rise and made policy recommendations without adequate consideration of the costs
- The degree to which data/information exists and are reliable and relevant
 - NCA5's unjustified assumptions about model reliability, and its use of short time periods for analysis, does not support its high-confidence conclusions
- The degree to which there is disagreement among experts, including those from different environments or academic fields
 - While NCA5 was an interdisciplinary effort, the concerns we have raised all point to a failure to canvass or communicate the full range of evidence, including data and research findings that speak against Key Messages.
- The degree to which the phenomena involved are understood and accurate models exist
 - NCA5 is not appropriately skeptical of the ability of climate models to attribute the causes of warming and extreme events or to project future climates, especially at the regional level
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns
 - A major NCA5 shortcoming is its dismissal of natural climate variability in many contexts where it should have been a major consideration

NCA5 is also problematic for informing policy because its exaggerated language promotes alarm and advocates for specific policies without a proper risk analysis. The NASEM Review of the NCA5 underscores the endemic nature of this problem - their review appears to be written by authors who share many of the biases of the NCA5 team, with an inordinate focus on social and policy issues. ~~It is then not surprising that objectivity can suffer when climate scientists communicate their understanding to non-experts. Further, the field of climate science has been politicized by NetZero mandates. This lack of objectivity usurps the public's right to make informed choices and undermines their confidence in the scientific enterprise.~~

~~Philip Handler, President of the National Academy of Sciences, identified the problem forty-five years ago in an editorial that still resonates:~~

~~Difficulty arises in the scientific community from confusion of the role of scientist *qua* scientist with that of scientist as citizen, confusion of the ethical code of the scientist with the obligation of the citizen, blurring the distinction between intrinsically scientific and intrinsically political questions. When scientists fail to recognize these boundaries, their own ideological beliefs, usually unspoken, easily becloud seemingly scientific debate.~~

~~[ALTHOUGH I VERY MUCH LIKE THIS TEXT, I THINK WE SHOULD DELETE IT IN AN EFFORT TO REMAIN CIRCUMSPECT]~~

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. Apart from the issue of the NCA4 being outdated for reliance in 2025, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability

- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

8.4 Recommendations for NCA6

While we have assessed NCA5 to be scientifically inadequate and unsuitable as a basis for decision-making, one can imagine a different National Climate Assessment that meets statutory and policy maker requirements. The goal should be not to persuade, but to impart understanding by being objective, transparent and complete. A suitable NCA would be an important complement to IPCC assessments to the extent that its analysis and conclusions differ from the “consensus” of the IPCC reports and additional topics are addressed. Such a report would promote a more open scientific discussion and a more informed policy debate.

We recommend that the NCA6 have a narrower scope than NCA5, refocusing on climate science, including natural climate variability, with topics to include:

- How the climate has changed in the past. The U.S. has the best and longest meteorological records and they should be examined and displayed in their entirety. Trend analyses should include longest periods available and employ suitable statistical methods. Local paleoclimate data should be considered where available. Analysis should demonstrate not only how the climate has varied and changed, but also regional heterogeneity. Standard, easily understandable metrics should be employed.
- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future. An example of a salient acute failure is the NCA5 chapter (region that includes Texas) that fails to mention the historical occurrence and future risk of flash floods in the Texas Hill Country ~~ROSS MAYBE MENTION WHAT NCA5 SAID ABOUT TX FLOODS in REGIONAL CHAPTER, THEN INCLUDE LINK TO YOUR MINI ANALYSIS~~
- A critical survey of current global and regional modeling capabilities and their suitability for regional impact assessments and projections. This would include an assessment of their ability to reproduce observed changes. It should also discuss alternative methods for generating scenario projections on regional and decadal scales, along the lines of Chapter 10 of the IPCC AR6 WGI Report.
- Assessment of the impacts of recent historical climate variability and change on ecosystems and society. Where long-term data indicate a detectable regional change, regional projections can be made for the period 2030-2050. Emissions scenarios exceeding RCP4.5/SSP2-4.5 and ECS values exceeding 4°C should not be used. Regional projections to 2100 have no credibility at this time.

It is important that climate projections be assessed in context of current science capabilities. The pressures toward spatially or temporally precise projections should be resisted as the current models are nowhere up to the task (an example is discussed in CWG25 Section 5.8). In that light, the many pages of NCA5 devoted to projected regional and sectoral impacts have little value.

Given the substantial deficiencies and bias in NCA5 that we have identified, producing an objective NCA6 report with the current NCA organizational construct would be a challenge. A NASEM review could help, but only if the selected participants reflect full viewpoint diversity and do not simply mirror the assumptions and biases of past NCA teams. We regard the CWG25 report to be a good start on NCA6 in terms of scope and objectivity, including adherence to the tenets of Gold Standard Science.

More broadly, we recommend a rewrite of the Global Change Research Act. The current mandate is vague and off point, allowing successive NCA teams to interpret the mandate as they see fit. Moreover, it is becoming increasingly clear that current and foreseeable models are not fit-for-purpose to describe regional climates, let alone usefully project them for 25 and 100 years. Further, the use of the term “global change” is ambiguous and outdated.

9 REFERENCES

- Aven, Terje (2017) “Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices,” *Reliability Engineering & System Safety* 167 (November 2017): 42–48
<https://www.sciencedirect.com/science/article/pii/S0951832016306950>
- Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.
- Diffenbaugh, N.S., D. Singh, and J.S. Mankin, 2018: Unprecedented climate events: Historical changes, aspirational targets, and national commitments. *Science Advances*, 4 (2), 3354.
<https://doi.org/10.1126/sciadv.aao3354>
- Kirchmeier-Young, M.C. and X. Zhang, 2020: Human influence has intensified extreme precipitation in North America. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (24), 13308-13313. <https://doi.org/10.1073/pnas.1921628117>
- Knutson, Thomas and Fanrong Zeng (2018) “Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends” *Journal of Climate* 31(12) <https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml>
- National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/26757>.
- NCA4. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I* (D. J. Wuebbles, D. W. Fahey, and K. A. Hibbard, Eds.). U.S. Global Change Research Program.
<https://doi.org/10.7930/J0J964J6>
- NCA5. (2023). *Fifth National Climate Assessment* (A. R. Crimmins et al., Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023.CH1>
- Schlund, Manuel, Axel Lauer, Pierre Gentine, Steven C. Sherwood, and Veronika Eyring (2020) Emergent constraints on equilibrium climate sensitivity in CMIP5: do they hold for CMIP6? *Earth System Dynamics* 11 1233-1258 <https://doi.org/10.5194/esd-11-1233-2020>

10 APPENDIX: CHARGE TO THE REVIEW

ABOUT THE AUTHORS

[Insert updated bios]

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Tuesday, July 15, 2025 6:47 PM
To: Ross McKittrick
Cc: John Christy; Judith Curry; Travis Fisher; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Works for me.
Steven E. Koonin

On Jul 15, 2025, at 18:33, Ross McKittrick <ross.mckittrick@gmail.com> wrote:

If Steve's away until Tuesday a Friday July 18 deadline won't be feasible, so let's work towards a Friday July 25 deadline.

I propose this week we go in the following order to prevent us working on overlapping drafts
Judy goes through the draft tonight
Steve has another look tomorrow.
Then Roy, then John, then me.

On Tue, Jul 15, 2025 at 3:47 PM John Christy <climateman60@gmail.com> wrote:

I like Judy's idea. It's one way to avoid going through the preparation and experience of something like a colonoscopy twice in one month.

John C.

On Tue, Jul 15, 2025 at 2:12 PM Judith Curry <curry.judith@gmail.com> wrote:

Here is a way around the NCA4 issue, propose adding the following text to end of section 8.3

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. However, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability
- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry
<curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick
<ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report.
Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

<image001.jpg>

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--

<image001.jpg>

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



To help protect your privacy, Microsoft Office prevented automatic download of this picture from the Internet.

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick [ross.mckittrick@gmail.com]
Sent: 7/15/2025 10:33:40 PM
To: John Christy [climateman60@gmail.com]
CC: Judith Curry [curry.judith@gmail.com]; Steven Koonin [steven.koonin@gmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

If Steve's away until Tuesday a Friday July 18 deadline won't be feasible, so let's work towards a Friday July 25 deadline.

I propose this week we go in the following order to prevent us working on overlapping drafts

Judy goes through the draft tonight

Steve has another look tomorrow.

Then Roy, then John, then me.

On Tue, Jul 15, 2025 at 3:47 PM John Christy <climateman60@gmail.com> wrote:

I like Judy's idea. It's one way to avoid going through the preparation and experience of something like a colonoscopy twice in one month.

John C.

On Tue, Jul 15, 2025 at 2:12 PM Judith Curry <curry.judith@gmail.com> wrote:

Here is a way around the NCA4 issue, propose adding the following text to end of section 8.3

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. However, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability
- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>

Sent: Tuesday, July 15, 2025 1:47 PM

To: Steven Koonin <steven.koonin@gmail.com>

Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climatemanager60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

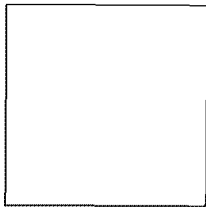
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

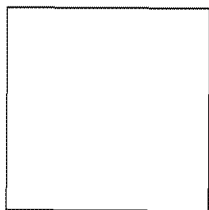
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



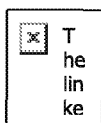
Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA

curry.judith@cfanclimate.com |
+1.404.803.2012
http://www.cfanclimate.net

From: John Christy <climateman60@gmail.com>
Sent: Tuesday, July 15, 2025 3:47 PM
To: Judith Curry
Cc: Steven Koonin; Travis Fisher; Ross McKittrick; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress
Attachments: image001.jpg

I like Judy's idea. It's one way to avoid going through the preparation and experience of something like a colonoscopy twice in one month.

John C.

On Tue, Jul 15, 2025 at 2:12 PM Judith Curry <curry.judith@gmail.com> wrote:
Here is a way around the NCA4 issue, propose adding the following text to end of section 8.3

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. However, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability
- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

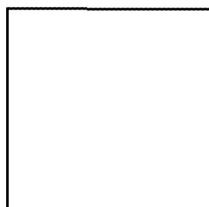
- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it

would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

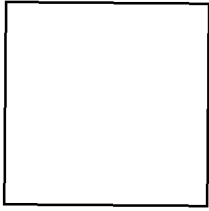
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

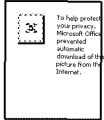


Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/15/2025 7:12:40 PM
To: Steven Koonin [steven.koonin@gmail.com]
CC: Travis Fisher [travis.scott.fisher@gmail.com]; Ross McKittrick [ross.mckittrick@gmail.com]; John Christy [climatemanager60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

Here is a way around the NCA4 issue, propose adding the following text to end of section 8.3

NCA4 provided a better assessment than NCA5 in terms of a more thorough consideration climate science, use of data back to 1901, and less of an advocacy tone. However, NCA4 shared the following endemic problems with NCA5

- Overconfidence in conclusions
- Inadequate treatment of natural variability
- Inadequate Traceable Accounts and communication of uncertainty
- Over reliance on extreme scenarios

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climatemanager60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKitrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

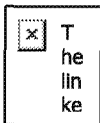
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



From: Judith Curry <curry.judith@gmail.com>
Sent: Tuesday, July 15, 2025 3:05 PM
To: Steven Koonin
Cc: Travis Fisher; Ross McKittrick; John Christy; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

I'll take a crack at adding some more NCA4 context to send tonite, so steve has a chance to comment

On Tue, Jul 15, 2025 at 12:02 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

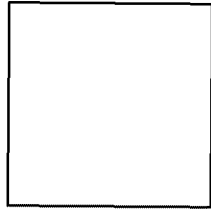
- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

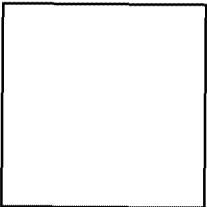
- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin [steven.koonin@gmail.com]
Sent: 7/15/2025 7:02:08 PM
To: 'Travis Fisher' [travis.scott.fisher@gmail.com]
CC: 'Judith Curry' [curry.judith@gmail.com]; 'Ross McKittrick' [ross.mckittrick@gmail.com]; 'John Christy' [climateman60@gmail.com]; 'Roy W. Spencer' [roywspencer@hotmail.com]; 'Josh Loucks' [loucksj14@gmail.com]; 'Seth Cohen' [seth.cohen@hq.doe.gov]
Subject: RE: NCA5 progress
Attachments: image001.jpg

Just a heads up that I will be on the West Coast with very limited connectivity from tomorrow (Wednesday) evening through Monday evening (West Coast times). Back on the East Coast early Tuesday morning.

SEK

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the

same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

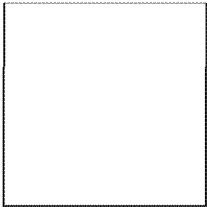
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

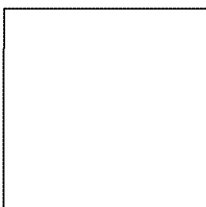
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |

+1.404.803.2012
<http://www.cfancclimate.net>

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 2:46 PM
To: Judith Curry
Cc: Ross McKittrick; Steven Koonin; John Christy; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

It was just an idea based on some of the political back-and-forth I've seen take place recently. I agree it gets us into the weird position of having to refute every govt report on climate change. Not great. I also don't want to add new work just as we're trying to wrap it up.

On Tue, Jul 15, 2025 at 2:32 PM Judith Curry <curry.judith@gmail.com> wrote:

What can we say about NCA4 that is more substantive than section 1.4? It still had the same problems with extreme scenarios, overconfidence etc. We should include such a statement in ch 8, stating that apart from the activist tone, the previous NCA reports had the same problem. Specifically with regards to NCA4 Vol 1, IMO that was a cut below the IPCC AR4 and much of that is significantly outdated.

On Tue, Jul 15, 2025 at 11:03 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Could have it in by the end of the week.

From Travis' comment our earlier material on the failure of nca4 peer review should stay in

On Tue, Jul 15, 2025 at 12:48 PM Judith Curry <curry.judith@gmail.com> wrote:

We might be close on the NCA5 report. Ross, an estimate?

On Tue, Jul 15, 2025 at 10:46 AM Travis Fisher <travis.scott.fisher@gmail.com> wrote:

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks

<loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry
<curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

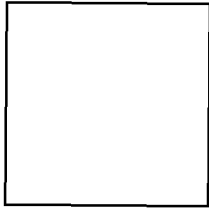
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

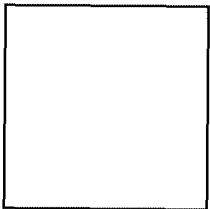
3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/15/2025 6:32:42 PM
To: Ross McKittrick [ross.mckittrick@gmail.com]
CC: Travis Fisher [travis.scott.fisher@gmail.com]; Steven Koonin [steven.koonin@gmail.com]; John Christy [climatemanager60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

What can we say about NCA4 that is more substantive than section 1.4? It still had the same problems with extreme scenarios, overconfidence etc. We should include such a statement in ch 8, stating that apart from the activist tone, the previous NCA reports had the same problem. Specifically with regards to NCA4 Vol 1, IMO that was a cut below the IPCC AR4 and much of that is significantly outdated.

On Tue, Jul 15, 2025 at 11:03 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
Could have it in by the end of the week.

From Travis' comment our earlier material on the failure of nca4 peer review should stay in

On Tue, Jul 15, 2025 at 12:48 PM Judith Curry <curry.judith@gmail.com> wrote:
We might be close on the NCA5 report. Ross, an estimate?

On Tue, Jul 15, 2025 at 10:46 AM Travis Fisher <travis.scott.fisher@gmail.com> wrote:
Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, I suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but it's too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What I'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are Christy, McKittrick, Koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the

same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

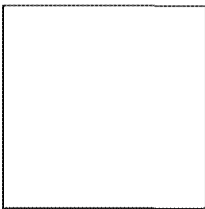
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

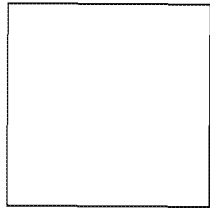
3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



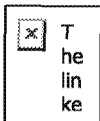
Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Roy Spencer <roywspencer@hotmail.com>
Sent: Tuesday, July 15, 2025 2:07 PM
To: Travis Fisher; Steven Koonin
Cc: Judith Curry; Ross McKittrick; John Christy; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Now that's a conundrum I would have never thought of:

"Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

If the most recent science assessment isn't assumed to be the best, how far back do we go? To before global warming was a thing? This would set quite a precedent...

"OK, maybe the latest IPCC report has some problems... but what about the first one?"

Ugh.

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 12:46 PM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: Judith Curry <curry.judith@gmail.com>; Ross McKittrick <ross.mckittrick@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,

Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

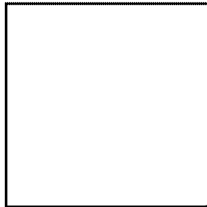
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

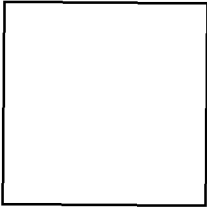
3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Tuesday, July 15, 2025 2:04 PM
To: Judith Curry
Cc: Travis Fisher; Steven Koonin; John Christy; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Could have it in by the end of the week.

From Travis' comment our earlier material on the failure of nca4 peer review should stay in

On Tue, Jul 15, 2025 at 12:48 PM Judith Curry <curry.judith@gmail.com> wrote:
We might be close on the NCA5 report. Ross, an estimate?

On Tue, Jul 15, 2025 at 10:46 AM Travis Fisher <travis.scott.fisher@gmail.com> wrote:
Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

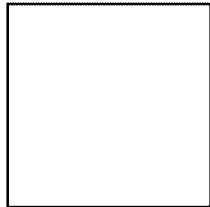
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

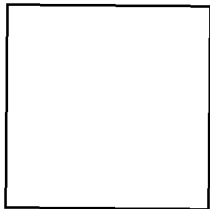
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



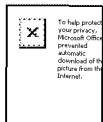
Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/15/2025 5:48:44 PM
To: Travis Fisher [travis.scott.fisher@gmail.com]
CC: Steven Koonin [steven.koonin@gmail.com]; Ross McKittrick [ross.mckittrick@gmail.com]; John Christy [climatemanager60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

We might be close on the NCA5 report. Ross, an estimate?

On Tue, Jul 15, 2025 at 10:46 AM Travis Fisher <travis.scott.fisher@gmail.com> wrote:
Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climatemanager60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

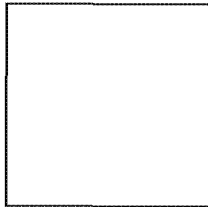
- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later

this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

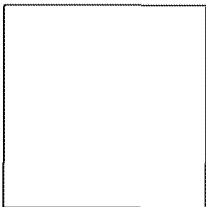
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



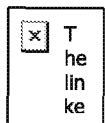
Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Travis Fisher <travis.scott.fisher@gmail.com>
Sent: Tuesday, July 15, 2025 1:47 PM
To: Steven Koonin
Cc: Judith Curry; Ross McKittrick; John Christy; Roy W. Spencer; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Hi all,

If we need to move quickly to publish the NCA critique as a DOE product, what would be a reasonable date for us to consider it final from the authors' point of view (subject to internal review for errors but not subject to political meddling)? I have to build a publication schedule, and I'd like to work backward from a date that's comfortable for you all.

I ask because the political powers that be are interested in having a published version to cite. Sooner is better, of course, but I don't want to jam you up. They certainly want it to be published before we could conceivably have a new head of the USGCRP, so it will have to be a DOE report.

Finally, if you're considering critiquing the entire NCA apparatus and previous reports, I think that would be helpful. The political response to an NCA5 critique so far has been (I'm paraphrasing), "Even if we show that NCA5 is not a solid basis for policymaking, what about NCA4 and prior reports?"

As always, please feel free to call me or convene a meeting if you want to discuss anything. I'll also try to keep everyone posted as the CWG report moves through the necessary hoops.

Best,
Travis

On Tue, Jul 15, 2025 at 11:41 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

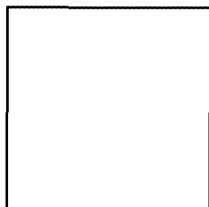
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

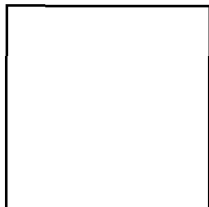
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin [steven.koonin@gmail.com]
Sent: 7/15/2025 3:41:26 PM
To: 'Judith Curry' [curry.judith@gmail.com]; 'Ross McKittrick' [ross.mckittrick@gmail.com]
CC: 'John Christy' [climateman60@gmail.com]; 'Roy W. Spencer' [roywspencer@hotmail.com]; 'Travis Fisher' [travis.scott.fisher@gmail.com]; 'Josh Loucks' [loucksj14@gmail.com]; 'Seth Cohen' [seth.cohen@hq.doe.gov]
Subject: RE: NCA5 progress
Attachments: image001.jpg; NCA5Review Curry SK.docx

I've marked up Judy's "desnarked" version (attached). Mostly typos and wording, but a few issues of substance. And still on the fence about whether and how to include the NCA4 story on temperature extremes.

SEK

From: Judith Curry <curry.judith@gmail.com>
Sent: Sunday, July 13, 2025 3:12 PM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What I'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are Christy, McKittrick, Koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

Critique of the Fifth National Climate Assessment

EXECUTIVE SUMMARY	3
1 INTRODUCTION	4
1.1 ABOUT THIS REPORT	4
1.2 ABOUT THE NATIONAL CLIMATE ASSESSMENTS	4
1.3 STANDARDS FOR ASSESSING NCA PRODUCTS	5
1.4 WHEN PEER REVIEW FAILED	ERROR! BOOKMARK NOT DEFINED.
2 NCA5 OVERVIEW CHAPTER: HYPERBOLIC ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE.....	6
3 OVERCONFIDENCE WHEN STATING CONCLUSIONS	7
3.1 INFLATED CERTAINTY LEVELS	7
3.2 OVERSTATING FINDINGS IN UNDERLYING SOURCES	9
3.3 TECHNICAL EXAMPLE: EMERGENT CONSTRAINTS	9
4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS.....	10
4.1 AVERAGE AND EXTREME PRECIPITATION.....	11
4.2 HEATWAVES.....	11
5 INADEQUATE TRACEABLE ACCOUNTS.....	14
6 OVEREMPHASIS ON EXTREME SCENARIOS	16
7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES	18
8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6.....	19
8.1 COMPLIANCE WITH USGCRP'S STATUTORY OBLIGATION	19
8.2 ADHERENCE TO THE TENETS OF GOLD STANDARD SCIENCE	20
8.3 SUITABILITY FOR INFORMING FEDERAL CLIMATE AND ENERGY POLICY	20
8.4 RECOMMENDATIONS FOR NCA6.....	21
9 REFERENCES	22
APPENDICES.....	ERROR! BOOKMARK NOT DEFINED.
APPENDIX 1: CHARGE TO THE REVIEW	24
ABOUT THE AUTHORS.....	25

EXECUTIVE SUMMARY

This report critically evaluates the Fifth National Climate Assessment (NCA5), finding it an inadequate basis for climate and energy policies. A detailed review of the foundational chapters on climate science raises several key concerns:

Scientific Integrity

- An advocacy tone, particularly in the Overview chapter, that is inconsistent with scientific objectivity
- A framing of climate policy as a morality play
- Endemic overconfidence when stating conclusions, including inflated certainty levels and overstatement of findings from underlying sources
- No mentions of dissent, disagreement, controversies, or tradeoffs

Flawed methodology

- Minimal discussion of observational inadequacies
- Use of short time periods for trend analyses; more generally lack of a consistent rule for choosing time scales
- Attribution is implied, not dissected
- Overemphasis on extreme scenarios for future emissions and sea level rise
- Inadequate traceable accounts to support key conclusions

Inadequate Review Process

- A review by the National Academy of Sciences, Engineering, and Medicine (NASEM) failed to identify some fundamental flaws in NCA5
- The NCA5 authors failed to adopt some improvements recommended by NASEM

The report shows NCA5 to be a biased and incomplete picture of climate science that skews toward excessive climate risk. Consequently, NCA5 should not be used as basis for climate and energy policies.

[I THINK THESE ARE NOW COVERED IN THE TEXT]

1 INTRODUCTION

1.1 About this Report

This report responds to a request from the Office of Science and Technology Policy (OSTP) Director Michael Kratsios (reproduced in the Appendix) [MAY HAVE TO MODIFY THIS] that we assess the suitability of the Fifth National Climate Assessment (NCA5 2023) for informing climate and energy policies.

To conduct this assessment, we reviewed NCA5 itself, the National Academies of Science, Engineering and Medicine (NASEM) review of the Third Order NCA5 Draft, and the USGCRP responses to that review. We have drawn upon our long experience working on advisory reports, including for the NASEM, the Intergovernmental Panel on Climate Change (IPCC), and other organizations as writers, reviewers, and study leaders.

We find that NCA5 should not be relied on for policy making as it is an incomplete and misleading picture of our understanding of the changing climate and the risks it poses to the nation. NCA5 was selective and incomplete in its survey of climate science. Further, we have reviewed recent scientific developments in a separate report to Energy Secretary Wright (Climate Working Group 2025, herein denoted “CWG25”). The overall effect of the biases and omissions of NCA5 is an excessively dire picture of climate risk.

To support our finding, the following sections of this chapter provide some background on the National Climate Assessments and the standards by which we have assessed NCA5. Chapters 2 through 7 detail important ways in which NCA5 fails to meet those standards. Finally, Chapter 8 summarizes our evaluation of NCA5 and makes recommendations for NCA6.

1.2 About the National Climate Assessments

The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to develop and coordinate “a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.”

The National Climate Assessment (NCA) Reports evolved from the GCRA requirement to:

Prepare and submit to the President and the Congress an assessment which (1) integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings; (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

The five NCA Reports to date have interpreted this mandate in different ways:

- NCA1 (2000) was a multidisciplinary effort to study and portray in regional detail the potential effects of human-induced global warming on the United States.

- NCA2 (2009) was a relatively short report that not only focused on the potential consequences of climate change but also sought to identify potential adaptation measures and identify the highest priorities for future research.
- NCA3 (2014) was an expanded effort that continued along the lines of NCA2, and was distinguished by a comprehensive review process, including a review by the National Academy of Sciences. NCA3 introduced a traceability analysis for each key finding, including a description of uncertainties.
- NCA4 (2017/2018) was a further expanded effort that was published in two volumes: I Climate Science Special Report (CSSR), and II Impacts, Risk, and Adaptation in the United States. This was the first NCA report to devote significant effort to assessing climate science.
- NCA5 (2023) returned to a single volume format, reducing discussion of climate science to a cursory two chapters, with continuing focus on regional and sectoral impacts of climate change. NCA5 expanded its remit to topics that are arguably outside the purview of the USGCRP, focusing on “Climate Action” and policy recommendations with a social justice emphasis.

These successive interpretations of the NCA are poorly aligned with the GCRA’s statutory requirements. Only NCA4 gives serious consideration to climate science, which receives the great majority of USGCRP funding, and even then NCA4 misrepresents some important points. Natural climate variability is essentially dismissed as unimportant in NCA4 and barely mentioned in NCA5 in most contexts, despite the mandate to include both human-caused and natural climate change. Most significantly, NCA5 has redirected the focus away from climate science and even the hazard elements of impacts, towards evaluation of societal vulnerabilities and advocacy for particular policy options, especially deployment of wind and solar power generation.

1.3 Standards for Assessing NCA Products

Beyond the statutory requirements stated above, another pertinent standard is President Trump’s executive order of May 23, 2025, Restoring Gold Standard Science. It enumerates some of the characteristics of good science, namely that it should be:

- i. reproducible;
- ii. transparent;
- iii. communicative of error and uncertainty;
- iv. collaborative and interdisciplinary;
- v. skeptical of its findings and assumptions;
- vi. structured for falsifiability of hypotheses;
- vii. subject to unbiased peer review;
- viii. accepting of negative results as positive outcomes; and
- ix. without conflicts of interest.

For an assessment of policy relevant science, it is also important to include statements about the strength of knowledge. The IPCC’s approach to assessing strength of knowledge is based on judgment of the available evidence and agreement among experts. But there are more sophisticated knowledge characterizations for risk management. Here are the elements according to Aven (2017):

- The degree to which the assumptions made are reasonable/realistic based on background knowledge

- The degree to which data/information exists and are reliable and relevant
- The degree to which there is disagreement among experts (including those from different environments or academic fields)
- The degree to which the phenomena involved are understood and accurate models exist
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns (issues that are known to matter but are ignored, such as, in this context, natural variability).

2 NCA5 OVERVIEW CHAPTER: ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE

NCA5 Chapter 1, “Overview”, holds a prominent place in the Report since it summarizes the entire report and is the only section that many will read. Chapter 1 is marred by an activist tone, language that aggressively promotes mitigation policies, and motivated optimism. As such, this chapter adds an imprimatur of scientific authority to naïve and simplistic declarations of opinion about public policy. Here are some examples .

Chapter 1 opens with:

The more the planet warms, the greater the impacts. Without rapid and deep reductions in global greenhouse gas emissions from human activities, the risks of accelerating sea level rise, intensifying extreme weather, and other harmful climate impacts will continue to grow. Each additional increment of warming is expected to lead to more damage and greater economic losses compared to previous increments of warming, while the risk of catastrophic or unforeseen consequences also increases.

This statement presupposes that all warming is anthropogenic, that all warming is bad and causes economic damage, and that warming intensifies extreme weather. Such sweeping generalizations go well beyond what science has or can establish. The statement also refers to growing risks without reference to their magnitude – a small risk that grows might still be a small risk, and a large risk might be only incrementally worsened.

On the next page one finds:

Each additional increment of warming leads to greater risks [here it lists 7 key components of society including food security and the economy] ... Without deeper cuts in global net emissions, climate risks to the US will continue to grow... Action to limit future warming and reduce risks can have near-term benefits and opportunities: low-carbon energy jobs, Improved air quality, Health benefits, Economic benefits...”

The authors write as if climate policy does not involve trade-offs and all measures to reduce future warming will be effective and beneficial. Neither the vast body of scholarship on climate science and economics nor historical experience support such simplistic claims (CWG25). Not every additional increment of warming leads to economic harms; in fact, NCA5 Chapter 19 acknowledges that there will also be benefits. Nor is climate policy guaranteed to benefit the economy; it could impose net costs. Such misleading statements are a disservice to policymakers.

Pages 8 and 9 of the Overview promote renewable energy options by noting, correctly, that the levelized costs of wind/solar generation have fallen sharply since 2010, and so offers this rationale for pursuing deep emission reductions:

Recent growth in the capacities of wind, solar, and battery storage technologies is supported by rapidly falling costs of zero- and low-carbon energy technologies, which can support even deeper emissions reductions. For example, wind and solar energy costs dropped 70% and 90%, respectively, over the last decade, while 80% of new generation capacity in 2020 came from renewable sources.

Yet it has long been known that intermittent renewables generation must be supplemented by dispatchable generation to meet grid reliability standards, and that doing so (*e.g.*, through natural gas, fission, or storage) significantly increases the total cost of electricity. Further, there are yet unmet synchronization challenges in electrical grids with heavy penetration of wind and solar generation. NCA5 fails to acknowledge these facts. But more importantly, we see no reason for NCA5 to be discussing renewable energy technologies and economics in the context of its mandate.

Page 17 of the Overview introduces the discussion of risks from extreme weather events by saying “Harmful impacts from more frequent and severe extremes are increasing across the country.” This creates the impression that extreme weather events are worsening and that disaster losses are driven by trends in extreme weather. While the section goes on to acknowledge that some of the increase is due to increases in the exposure and value of assets at risk, it then invokes the NOAA Billion Dollar Dataset as evidence of extreme weather getting worse. Scientists have shown that this is an invalid metric (CWG25 Section 10.2) since it measures the growth of the economy not the frequency of extreme weather, and indeed NOAA has recently withdrawn the data product. Even though the dataset was still distributed by NOAA at the time of the NCA5, the report authors failed to assess it skeptically and see that it was unfit for the purpose of measuring climate trends.

Page 23 of the Overview states, in large font:

Climate changes are making it harder to maintain safe homes and healthy families; reliable public services; a sustainable economy; thriving ecosystems, cultures, and traditions; and strong communities.

This statement can’t be evaluated on scholarly grounds and so doesn’t belong in a scientific assessment report. Its prominent inclusion points not only to the willingness of NCA5 authors to promote alarm, but also the ineffectiveness of the review process in eliminating such statements.

3 OVERCONFIDENCE WHEN STATING CONCLUSIONS

3.1 Inflated certainty levels

Overconfidence in stating conclusions has been an endemic problem in NCA Reports. The authors frequently make sweeping generalizations without appropriate caveats or acknowledging uncertainties. The overconfidence begins with inflated language to describe certainty levels.

NCA5 uses specific terms to convey information about scientific confidence associated with important finds, observations and projections. The Front Matter of NCA5 states that

confidence in a finding is based on the type, amount, quality, strength, and consistency of evidence; the skill, range, and consistency of methods to detect, evaluate, attribute, and interpret climate trends; and the degree of agreement across scientific information sources.

Table 1 from the Front Matter provides calibrated language for confidence assessment:

Very high:	Strong evidence (established theory, multiple sources, well documented and accepted methods, etc.). High consensus
High:	Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.). Medium consensus
Medium:	Suggestive evidence (a few sources, limited consistency, methods emerging, etc.) Competing schools of thought.
Low:	Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.). Disagreement or lack of opinions among experts.

This terminology is obviously inflated: *high confidence* with just moderate evidence and medium consensus; *medium confidence* with only suggestive evidence and competing schools of thought. This inflation in terminology leads to overconfidence in conclusions.

Even with this inflated terminology, NCA5 further inflates the confidence level of many of its conclusions to well beyond what the IPCC has concluded with more thorough justification, and by incorrectly applying its own standards. An example is the conclusion about anthropogenic influence on climate change, arguably one of the most important scientific statements of the report.

Key Message 3.1 Traceable Account states:

There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have unequivocally caused *all* global warming observed over the industrial era.

while the corresponding statements from IPCC AR5 and AR6 are

AR5: It is *extremely likely* that *more than half* of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. (IPCC, 2013)

AR6: The *likely* range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C. It is *likely* that well-mixed GHGs contributed a warming of 1.0°C to 2.0°C, other human drivers (principally aerosols) contributed a cooling of 0.0°C to 0.8°C, natural drivers changed global surface temperature by –0.1°C to +0.1°C, and internal variability changed it by –0.2°C to +0.2°C. It is *very likely* that well-mixed GHGs were the main driver of tropospheric warming since 1979.

The IPCC AR5 and AR6 statements provide likelihood assessments but not a confidence level. While NCA5 claims with *very high confidence* that fossil fuels have unequivocally caused *all* global warming, AR5 refers to “*more than half* of the observed warming” and AR6 provides a more nuanced statement that relates to a *likely* range of warming contributed to by human drivers.

3.2 Overstating findings in underlying sources

Although we did not do a detailed audit of NCA5's use of source material, spot checks suggest a pattern of overstatement.

Chapter 2 page 11 reports on an increase in precipitation in some areas and attributes it to "climate change":

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

NCA5 attributes the claim to Knutson and Zeng (2018). But Knutson and Zeng did not say these things nor did they analyze this particular period. For 1981-2010 they cautioned that observed changes are consistent with natural variability, and they did not claim attributable trends were observed over the United States.

As another example of overstating findings, NCA5's Chapter 2 page 18 states

There is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US.

This is apparently attributed to Diffenbaugh *et al.* (2018) and Kirchmeier-Young and Zhang (2020). Diffenbaugh *et al.* presented ratios of observed occurrences of extreme events to simulated occurrence rates in CMIP6 models run with only natural forcings. They report that for 79% of the U.S., extreme rainfall events are currently more frequent than in simulations, and the ratio of occurrences will rise under future warming simulations. This is not "robust" evidence of anthropogenic influence since it requires readers to assume that climate models accurately simulate regional precipitation patterns, something that the IPCC AR6 states is uncertain (AR6 WGI SPM Box SPM 1.2, SPM Section C.1.3).

Kirchmeier-Young and Zhang used three global climate models to analyze extreme 1- and 5-day events in North America. They noted large differences among the three models in their simulated precipitation changes, and two of the three models failed to yield attribution for 5-day events for the North America mean. [DON'T UNDERSTAND THIS PHRASE] In other words, the models disagreed on whether the observed changes were anthropogenic. Both of the cited references utilized the implausible RCP8.5 scenario (Chapter 6 of this report) and began their "historical" observational records only in 1961. Here again this is not "robust" evidence. It is merely suggestive, particularly since other studies have found natural variability to be predominant.

3.3 Example: Emergent constraints

Some of the overconfidence expressed by NCA5 arises by omitting discussion of counterevidence in the peer reviewed literature, ignoring dissent and disagreement. An example is the topic of "emergent constraints". NCA5 Chapter 3 page 17 invokes this concept to support its claim that key uncertainties in climate model projections have been reduced:

An approach to reduce uncertainty in climate change projections has matured over the past decade. It is known as "emergent constraints." The term refers to strong statistical relationships between highly uncertain future climate parameters and observable trends or variations in the current climate, along with a physical explanation of this relationship.

Emergent constraints appeared in the climate modeling literature as an attempt to tie climate model behavior to climate observations in hopes of generating insight into real-world equilibrium climate sensitivity (ECS). Climate models exhibit a wide range of ECS values. The idea of emergent constraints is to examine whether the models with shared sensitivity values also share a common representation of some climate process (usually related to clouds) that might influence ECS. Suppose, for instance, that in low-ECS models the total cloud fraction in the tropics is strongly correlated with that in the southern midlatitudes, but in high-ECS models the correlation is weak. Then researchers could examine whether the observed correlation is strong or weak and draw a conclusion about which type of model, and therefore which ECS value, is more likely.

A problem in the emergent constraint literature is that there has been a proliferation of proposed correlations with little physical motivation. NCA5 alludes to this in the Traceable Accounts section (p. 3-40) but not in the main chapter text. As shown by Schlund *et al.* (2020), many emergent constraints patterned on CMIP5 models (Coupled Model Intercomparison Project No. 5, used for the IPCC 5th Assessment Report) failed to work on CMIP6 models (used for the IPCC 6th Assessment Report). In other words, the correlations between ECS and cloud processes present in CMIP5 models were absent in CMIP6 models, indicating that they were likely spurious rather than clues to physical processes governing the climate system. As a result, emergent constraints estimated on CMIP5 models *increased* the uncertainty of ECS, rather than decreasing it as claimed by NCA5.

Yet NCA5 described the use of emergent constraint analysis as an advance that reduced the uncertainty of ECS and climate model projections (p. 3-38):

Emergent constraints have been widely applied to reduce the simulated spread in the climate feedbacks that shape climate sensitivity.

4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS

CWG25 Chapter 6 discussed the need for care in the choice of time scale when making claims about trends in extreme weather. We provided examples from analysis of river flooding, heatwaves, and extreme precipitation to show how assertions about apparent trends based on short data sets fall apart when considering longer versions of the same data sets. NCA5 uses varying time periods for trend analyses, especially in Chapter 2 (which is focused on trends), without explaining why shorter or longer intervals were chosen. For example, page 2-4 defines temperature trends with respect to the interval since the late 1800s whereas page 3-29 presents temperature trends over 1972-2021. Page 2-11 compares rainfall over the 2002-21 versus 1901-1960 intervals while page 2-18 uses the interval since the late 1950s to compute trends.

A further problem is that NCA5 uses the term "trend" repeatedly without indicating if it is statistically significant (*i.e.*, distinguishable from random variability); the ambiguity creates the impression all the observed changes were significant, but readers are left to speculate. All climate variables will, in principle, drift up or down over any particular time interval. Identifying the change as a trend requires showing that it is statistically significant using a variance estimator suitable for the type of

data being analysed. Of particular importance is choosing a method robust to the serial correlation that is frequently present in climate data. Throughout Chapters 1 to 3, references are made to “trends” without explaining how they were computed. The exception was on page 1-19 which refers to urban temperature trends being calculated using the Theil-Sen estimator, although that method does not seem to have been used elsewhere. The one case where reference is made to statistical significance is on Page 2-9 referring to a trend in Atmospheric Optical Depth, but no explanation is given of how significance was determined. Page 2-19 refers to regional trends in droughts being “robust” but again fails to explain how the term was defined.

In this chapter when we refer to calculation of trends in precipitation, we use ordinary least squares to compute the linear trend over the entire sample length and we use the Vogelsang and Franses (2007) variance estimator which is robust to general forms of serial correlation. [IS THIS PARAGRAPH A QUOTE FROM NCA5? IF SO, NEED TO INDENT AND ADD SOME COMMENTARY. IF NOT, IT ISN'T CONNECTED TO THE REST OF THE TEXT]

4.1 Average and Extreme Precipitation

CWG25 Section 6.4 we presented analyses of updated data for the same locations [SAME AS WHAT?] (and many others), in all cases finding both considerable regional heterogeneity and that trends detectable on one time scale are often not detected on longer or shorter time scales. These findings argue against simple attribution of changes to anthropogenic influences.

NCA5 did not continue the NCA4 precedent of using the post-1901 interval as the time scale for its precipitation discussion. Instead, it refers to changes “since the 1950s”; NCA5 Figure 2.8 suggests 1958 might be the intended start date. Under Key Message 2.2, “Extreme Events Are Becoming More Frequent and Severe”, NCA5 states (p. 2-18):

Rainfall is becoming more extreme
Since the 1950s, there has been an upward trend in heavy precipitation across the contiguous US. This increase is driven largely by more frequent precipitation extremes, with relatively smaller changes in their intensity.

In addition to our concerns that inferences about trends are contingent on choice of time scale, if the intended meaning of this statement is that positive and significant trends are found in heavy precipitation events across CONUS, we cannot reproduce it. Details of our analysis can be found at [LINK TO BRIEF WRITEUP ON THIS](#) can we just reference CWG HERE

Based upon our analysis, the following is a more accurate summary of what U.S. precipitation data show.

There are regionally heterogeneous changes in average and extreme precipitation. Positive trends in annual average rainfall and extreme events (defined either as the annual maximum or the number of exceedances of the 99th percentile value) are generally weak or non-existent when looking at samples exceeding 130 years in length. Significant trends can be found when beginning the sample in the 1950s although in most cases the trends weaken and become insignificant when looking at the post-1980 interval. This argues against attribution of changes in precipitation to anthropogenic warming.

4.2 Heatwaves

In contrast to NCA5, NCA4 examined heat extremes across the entire 20th century, pointing out that peak heat wave activity was reached in the 1930s and has decreased since then, and that recent increases are confined to areas west of the Rockies. NCA4 stated:

[The] warmest daily temperature of the year increased in some parts of the West over the past century, but there were decreases in almost all locations east of the Rocky Mountains. In fact, all eastern regions experienced a net decrease, most notably the Midwest (about 2.2°F [1.2°C]) and the Southeast (roughly 1.5°F [0.8°C]).

Since the mid-1960s, there has been only a very slight increase in the warmest daily temperature of the year (amidst large interannual variability). Heat waves (6-day periods with a maximum temperature above the 90th percentile for 1961–1990) increased in frequency until the mid-1930s, became considerably less common through the mid-1960s, and increased in frequency again thereafter. As with warm daily temperatures, heat wave magnitude reached a maximum in the 1930s. (NCA4 pp. 190-191)

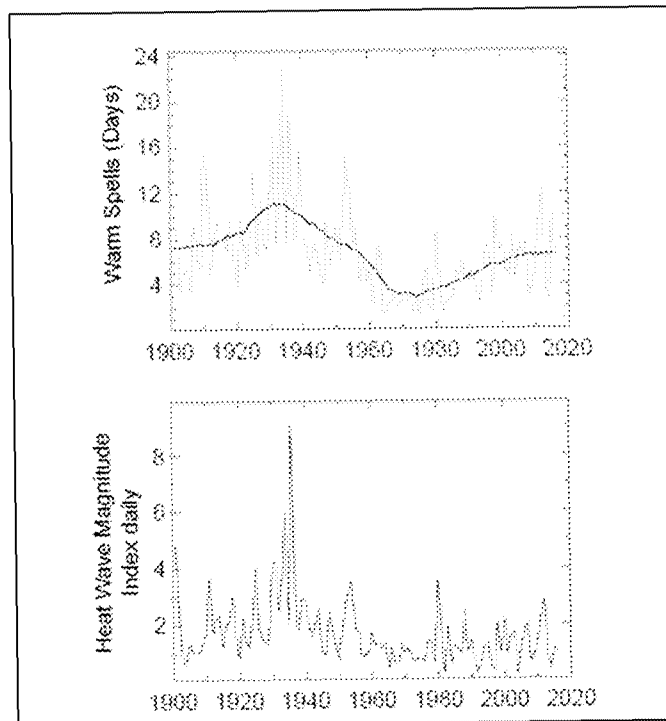


FIGURE 3. U.S. Heat waves since 1900. Reproduction of NCA4 Figure 6.4

Contrast this careful and factual language from NCA4 with NCA5 Key Message 2.2: “Extreme Events Are Becoming More Frequent and Severe.” This blanket statement is followed by NCA5 Figure 2.7 (reproduced as Figure 4 below) which shows the number of hot days, cold days and warm nights (respectively in panels a—c) over the period 2002-2021 compared to 1901-1960. [Presumably these are annual counts, although not stated in the caption.]

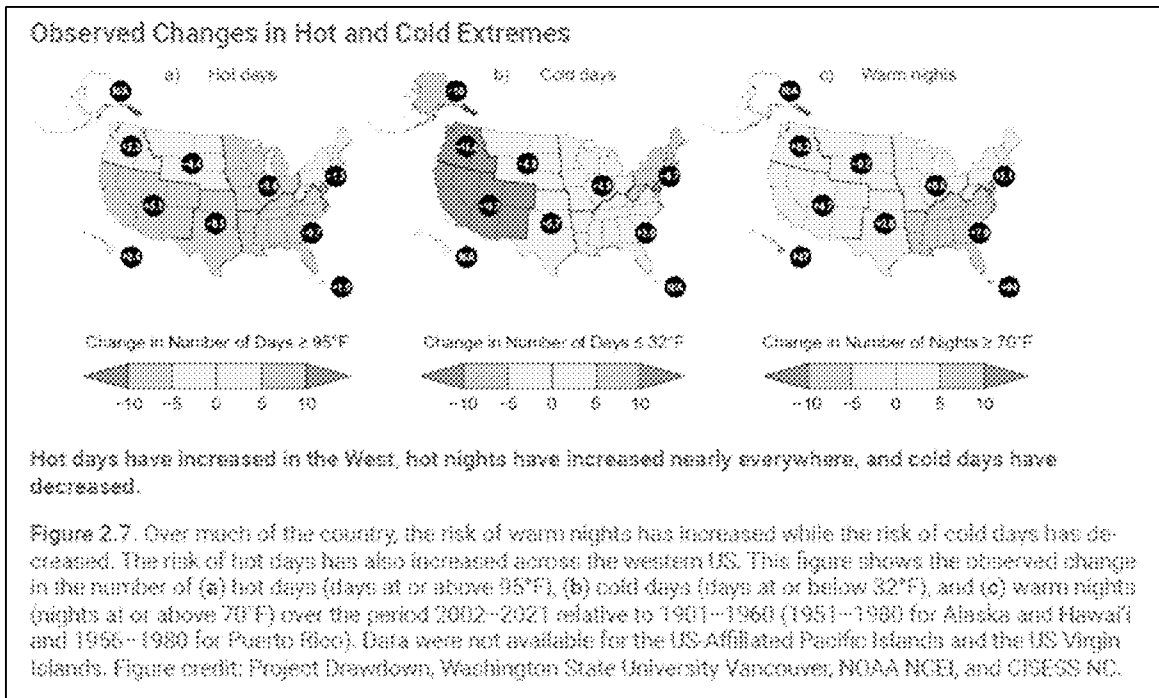


FIGURE 4: Reproduction of NCA5 Figure 2.7.

Close inspection shows that this figure actually contradicts the NCA5 Key Message with respect to heatwaves and instead reinforces the position of NCA4. Notwithstanding Key Message 2.2, the leftmost panel in NCA5 Figure 2.7 above shows that over most of CONUS the number of extreme heat days has *decreased* in recent decades compared to the prior century.

The accompanying discussion in NCA5 becomes convoluted as it appears to be aimed at supporting the Key Message despite the contrary evidence. NCA5 Chapter 2 elaborates on Key Message 2.2 by stating (page 2-16):

Observations show an increase in the severity, extent, and/or frequency of multiple types of extreme events. Heatwaves have become more common and severe in the West since the 1980s (*high confidence*).

But while it mentions the increase in hot days in the West, it fails to mention the decrease everywhere east of the Rockies. On the next page (page 2-17) it raises the comparison to the 1930s and then switches to discussing global counts:

By some measures, the most extreme heatwaves on record in the United States occurred during the Dust Bowl era of the 1930s. ... Globally such heatwaves are becoming more frequent, and in recent decades the western United States has been following those trends.

The reference to a global trend seems to be an attempt to tie heatwaves to anthropogenic climate change. But the obvious question, unaddressed by NCA5, is why one region follows the global pattern of increasing heatwaves while most of the country is trending in the opposite direction. These issues are addressed in Chapter 6 of CWG25, demonstrating that the range and magnitude of extreme temperatures are driven more by natural variability than by anthropogenic forcing. The analysis in CWG25 shows that for both (a) hot days ($\geq 95^{\circ}\text{F}$) and (b) number of days in heatwaves, the current decade is no hotter than a century ago in the U.S. Thus, the NCA5 claim that “multiday heatwaves

have become hotter, more frequent, larger, and longer lasting in recent decades,” is simply false when expanding the temporal and spatial domains to encompass all available data (Chapter 6 and Figure 6.3.6 of CWG25).

NCA5 then pointed to the dramatic Pacific Northwest heatwave of 2021. CWG2025 Section 8.6.1 discusses this event in detail, reviewing the multiple peer reviewed studies that explained the unusual meteorological context was unrelated to human-caused climate change, a point omitted from the NCA5 discussion.

NCA5 finally addresses the declining heatwave trend in CONUS east of the Rockies but attempts to reframe it by focusing on urban warm spells.

[The] number of very hot days has actually decreased across the central and eastern regions due to summer cooling trends in the region (Figure 2.7; Ch. 22). This does not, however, mean the central and eastern US are not affected by heat. The impacts of extreme high temperatures are more severe if such conditions persist for several days, and overall, multiday heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades. Across 50 large US cities, the US Global Change Research Program heatwave indicator (<https://www.globalchange.gov/indicators/heat-waves>) shows that the average number of heatwaves has doubled since the 1980s, and the length of the heatwave season has increased from about 40 days to about 70 days.

We discussed this part of NCA5 in CWG25 Section 6.3. The figure referenced by NCA5 uses a short time period which begins in the 1960s, the coldest decade in the last 100 years, thus suppressing any comparison to the 1930s. Further, nighttime temperatures in urban areas have increased faster than daytime temperatures (which NCA5 acknowledges), but this is a signature of urban heat islands and not a good metric of climate change. CWG25 found that the occurrence of hot days ($\geq 95^{\circ}$ F) has recently increased in the West, but declined since 1899 in the remainder of the country and in the nationwide average.

5 INADEQUATE TRACEABLE ACCOUNTS

NCA3 began the practice of including a section on Traceable Accounts at the end of each chapter. This is the description from NCA5:

Each chapter concludes with a section entitled Traceable Accounts, which provides information on the overall process used to develop the chapter as well as a separate Traceable Account section for each Key Message. These Traceable Accounts describe the supporting evidence behind each Key Message, the process and rationale authors used in reaching their conclusions, and the author team’s expert assessment of the confidence in and, where applicable, likelihood of these conclusions. As such, Traceable Accounts provide information about the state of the science, document sources of uncertainty, identify research gaps, and allow traceability to data and resources.

The Traceable Accounts for each Key Message includes the following sections:

- Description of Evidence Base
- Major Uncertainties and Research Gaps

- Description of Confidence and Likelihood

The Traceable Accounts could have addressed the statutory requirement that the NCA discuss scientific uncertainties. They could also help satisfy the Executive Order for Restoring Gold Standard Science by addressing reproducibility, transparency, communication of error and uncertainty, and skepticism of findings and assumptions. However, the Traceable Accounts in NCA5's Chapters 2 and 3 are uneven, often superficial and uninformative.

An example of a deficient Traceable Account is NCA5's Key Message 2.2: "Extreme Events are Becoming More Frequent and Severe". The "Description of the Evidence Base" offers two paragraphs, the first summarizing the findings and the second generically describing the types of data that can be used for storms. "Major Uncertainties and Research Gaps" focuses on the uneven distribution across U.S. populations due to differences in exposure and vulnerability. The only limitations in data referred to are the lack of a long-term record of lightning and the lack of homogenized daily and hourly temperature data apart from reanalysis products.

But the most astonishing deficiency is in the "Description of Confidence and Likelihood." One of the statements in Key Message 2.2 is:

Hurricanes have been intensifying more rapidly since the 1980s (*high confidence*) and causing heavier rainfall and higher storm surges (*high confidence*).

The Description of Confidence and Likelihood includes the following statement:

Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why the authors also have high confidence that storms are delivering more rainfall and high confidence that storm surges are becoming higher.

No reference to journal publications or a specific data set is made anywhere in the chapter regarding hurricane-induced precipitation or storm surge to support this *high confidence* conclusion.

The Traceable Accounts for the various Key Findings of Chapter 3 have some substantial inconsistencies. Consider

Key Message 3-1: Human activities have caused global warming.

Confidence and Likelihood: "There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have *unequivocally* caused all global warming observed over the industrial era. There is also *very high confidence* that changes in natural climate drivers have had globally small and regionally variable long-term effects over this period."

The Uncertainties section addresses only uncertainties in radiative forcing by greenhouse gases, ignoring the great uncertainty in model response (CWG25 Chapters 4 and 5) In contrast, the Traceability Analysis of Key Message 3-4 ("Humans Are Changing Earth System Processes") raises the problem that relatively little is known about the role of natural variability at the regional scale. From its Description of Evidence Base:

In the last decade, there has been increasing recognition of the role of regional-scale natural variability in the past and future evolution of climate, as well as the fact that regional natural variability signals can be competitive with forced anthropogenic signals.

And from its Major Uncertainties and Research Gaps:

For example, the true natural variability of the climate system on decadal to centennial timescales could be larger than what we estimate from GCMs, which would further increase the irreducible uncertainty stemming from natural variability.

These statements are among the most scientifically credible in the entire NCA5 and they directly undercut the confidence assigned to Key Message 3-1.

There is also a generic problem in tracing NCA5's Traceable Accounts. The Front Matter of NCA5 states:

Each figure and some tables are accompanied by a metadata survey, which can be accessed in the online version of the report by clicking on the eyeball icon above the figure or table (see the table below for explanations of additional icons used throughout the report). The metadata survey describes data sources, figure or table development methods, copyright information, and other important documentation.

Clicking on the 'eyeball' icon does not reveal the metadata information; instead a "Contact Us" email appears, addressed to the USGCRP. This is an inadequate way to archive the metadata information.

In summary, the Traceable Analyses examined here, with few exceptions, fail to meet the stated objectives of the NCA.

6 OVEREMPHASIS ON EXTREME SCENARIOS

To respond to the GCRA mandate to "project major trends for the subsequent 25 to 100 years," NCA5 relies on projections of future climate change based on estimates of future emissions (the so-called SSP scenarios) and/or specified levels of radiative forcing (the RCP scenarios). For the most part, NCA5 uses scenarios developed for the IPCC Assessment Reports.

CWG25 Section 3.2.1 presented a critical assessment of past and current IPCC scenario envelopes, showing that they have tended to overshoot observed emissions. IPCC AR6 published in 2021 stated that "The likelihood of high-emission scenarios like RCP8.5 and SSP5-8.5 is considered low in light of recent energy sector developments." and that same year UN Climate Negotiators (COP) stopped using scenarios above 4.5.

NCA5 makes the following observations about the scenarios they use:

NCA5 authors were advised to assess the full range of scenarios available. (Front Matter)

Scenarios of future emissions and land-use change are developed as plausible alternatives, but no relative likelihood is attached to them. Some recent studies, however, have argued that

the highest scenario, SSP5-8.5, is no longer plausible without a reversal of current trends in the adoption of renewables and energy efficiency. (Key Message 3.3 Traceable Analysis)

Despite acknowledging the issue, NCA5 otherwise ignored the problem. A keyword search of NCA5 of mentions of RCP/SSP scenarios finds over 50% referred to the extreme emissions scenarios RCP8.5/SSP5-8.5. Further, nine NCA5 figures (5.2, 6.9, 7.4, 11.3, 14.6, 22.13, 22.19, 27.9, 29.13) included *only* the 8.5 scenarios.

The problem of relying on extreme scenarios is particularly acute for NCA5's sea level rise projections. The sea level rise scenarios used in NCA5 do not relate directly to the SSP emissions scenarios, but rather to specified amounts of sea level rise by 2100. Table 4 of NCA5's "Guide to Using this Report" reproduced below shows that Low relates to 0.3 m (0.98 feet), Intermediate-Low relates to 0.5 m (1.64 feet), Intermediate relates to 1.0 m (3.28 feet), Intermediate-High relates to 1.5 m (4.92 feet), and High relates to 2.0 m (6.56 feet).

Table 4. Descriptive Terms for Common Sea Level Rise Scenarios Used in NCA5						
Future global mean sea level rise and sea level rise along United States coastline are shown for five scenarios in feet (and meters), relative to a 2000 baseline. The US values shown in the right half of the table are averaged across the US coastal regions, including the contiguous US, Alaska, Hawaii, and the US-Affiliated Pacific Islands, and the US Caribbean. The national values shown in the table differ substantially from regional values. For example, sea level rise is higher in the Gulf Coast and lower or even negative in some parts of Alaska. In the next 30 years (2020–2050), sea level along the contiguous US coasts is expected to rise 0.92 feet (0.28 m), the same amount of sea level rise observed over the last 100 years (1920–2020). See Chapter 9 for regional sea level information. Adapted from Sweet et al. 2022.”						
Sea Level Rise Scenario Descriptor	Global Mean Sea Level			United States		
Year	2050	2100	2150	2050	2100	2150
Low	0.49 (0.15)	0.98 (0.3)	1.31 (0.4)	0.59 (0.18)	0.98 (0.3)	1.64 (0.5)
Intermediate-Low	0.66 (0.20)	1.64 (0.5)	2.62 (0.8)	0.75 (0.23)	1.64 (0.5)	2.95 (0.9)
Intermediate	0.92 (0.28)	3.28 (1.0)	6.23 (1.9)	0.89 (0.27)	3.28 (1.0)	6.89 (2.1)
Intermediate-High	1.21 (0.37)	4.92 (1.5)	8.86 (2.7)	1.12 (0.34)	4.92 (1.5)	8.86 (2.7)
High	1.41 (0.43)	6.56 (2.0)	12.14 (3.7)	1.38 (0.42)	6.56 (2.0)	12.46 (3.8)

TABLE 1: Reproduction of Table 4 from the Front Matter of NCA5

Considering only projections representing processes quantified with at least medium confidence, IPCC AR6 assessed global mean sea level projections for all emissions scenarios (including implausible extreme emissions scenarios) for 2100 to fall between 0.2 and 1.6 m (5th—95th percentile range). Nevertheless, the range of sea level rise scenarios considered by NCA5 extends to 2.0 m. Further, NCA5 fails to include plausible lower scenarios, such as 0.2 m cited by the IPCC, which also corresponds to the average rate of sea level rise over the past century.

Chapter 9 of NCA5 offers the following predictions of sea level rise:

“Under a range of potential global warming levels, average sea level along US coastlines is *likely* to be between 12 and 20 inches above 2000 sea levels in 2050 (Figure 9.2).”

The projected sea level rise values span from the Intermediate scenario to values slightly greater than the High scenario. They can be put into context by considering the observed global sea level rise from 2000-2024, which is only approximately 3.4 inches (0.28 feet). NCA5 is thus projecting a sea level rise during 2025 and 2050 that is 3.5 to 5.8 times the rate observed during 2000-2024, an exceedingly implausible outcome. Chapter 9 further states:

“Looking toward the future, an 11 inch (28 cm) average rise along the contiguous US coastline is expected by 2050 (relative to 2020), with a *likely* range of 9-13 inches.”

...

“There is *high confidence* and it is *likely* that sea levels will rise about 11 inches (likely range of about 9–13 inches) between 2020 and 2050”

In summary, NCA5 presents future sea level rise scenarios that are not directly relatable to either SSP/RCP emissions scenarios or to plausible global warming levels. The NCA5 scenarios include two that are higher than the 95th percentile for the extreme emissions scenario RCP8.5 and include hypothesized ice sheet processes in which there is low confidence. Projections to 2050 require rates of sea level rise from 2025 to 2050 that are more than triple the rate observed during 2000-2024. Further, NCA5 ascribes *high confidence* to these sea level rise projections. CWG25 Section 7.3 provides further context for USGCRP projections of extraordinary sea level rise in the next 25 years.

More generally, NCA5’s inclusion of, and even focus on, implausible extreme scenarios supports projections of alarming impacts that are very unlikely to be driven by anthropogenic warming.

7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES

NCA5’s Glossary defines “climate change” as a change in climate for any reason. This is technically correct, but at variance with the (now) popular perception of all climate changes being anthropogenic. The distinction is not academic- it is central both to attribution questions and to projections, since anthropogenic changes would respond to mitigation, while natural changes are unavoidable.

The discussion on NCA5 page 2-4 begins “Human activities are changing the climate”, then goes on to list evidence for anthropogenic GHG emissions and climate warming. The next paragraph begins “Climate change is happening now in the United States. Including Alaska, the continental US has been warming about 60% faster than the planet as a whole since 1970.” The implication is that the warming of CONUS faster than the planetary average is an effect of GHG emissions. But it is an artifact of the Earth’s surface being 70 percent ocean. Since the ocean warms more slowly than land, comparison of any land surface outside the tropics with the global average would show the land surface to be warming faster than the global average, regardless of the cause of the warming.

The same page goes on to say “Climate change is already affecting people in the United States. Extreme heat was estimated to be responsible for more than 700 deaths per year between 2004 and 2018 although some estimates put heat-related mortality closer to 1,300 deaths annually.” But extreme heat, whether natural or not, has always been a risk to human health. As to trends, the data show that adaptation has caused the mortality burden of extreme heat to drop substantially in recent decades (CWG25 Section 10.3.1).

Consider also the NCA5 statement on precipitation cited in Section 3.2:

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

The attribution is superfluous because the statement is a tautology by NCA5's definition of climate change. But its gratuitous inclusion effectively attributes the observed trend to greenhouse gas emissions.

Exploitation of the ambiguity in "climate change" is endemic to NCA5. The NASEM review (pp. 23-24) commented on this problem as follows:

The draft NCA5 report frequently describes "change" but does not consistently distinguish between natural variability and climate change. This lack of clarity can be misleading for the reader by creating the misconception that some impacts that are the result of the combination of natural variability and climate change are instead solely due to climate change... it is important for NCA5 authors to accurately identify the multiple drivers of change (including global change), in addition to climate change, and accurately attribute impacts. Clearly describing impacts due to natural variability, climate change, or a combination of the two is important not only for informing policy decisions, but also for building public understand and trust in the report's messages. Climate change and natural variability should be clearly defined in the glossary and natural variability could be introduced in chapter introductions when the concept is important for understanding key messages.

This could have been easily addressed, for example by reserving the term "climate change" for anthropogenic changes and using "climate variability" for natural changes. But the NCA5 authors seemingly ignored their recommendation.

A separate but related issue is use of the term "climate change" to refer to increases in socioeconomic vulnerabilities that have anthropogenic but non-GHG-related causes. NCA5 page 1-19 states "Climate change exacerbates inequalities." But the issue discussed is the negative correlation between neighborhood-level income and land surface temperatures in urban areas. To the extent the correlation is real, the most likely explanation is that low-income households concentrate where housing is less expensive, which may be in neighborhoods with less nearby parkland and tree cover, which has nothing to do with CO₂ emissions.

8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6

This chapter summarizes our evaluation of NCA5 relative to OSTP's charge: whether NCA5 (1) complied with the USGCRP's statutory obligation; (2) adheres to the core tenets of Gold Standard Science; and (3) can suitably inform federal climate and energy policy. The points made in this summary analysis refer to specific sections of this report as well as to the CWG25 report.

8.1 Compliance with USGCRP's statutory obligation

As cited in Section 1.2 of this report, the Global Change Research Act requires an assessment that:

- (1) integrates, evaluates, and interprets the findings of the [Global Change Research] Program and discusses the scientific uncertainties associated with such findings;

- (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

We deem NCA5 to have fallen short when evaluated against these criteria because of the following major shortcomings (each is detailed in the chapters cited):

- Inadequate assessment of the relevant topics in climate science and the hazard components of climate impacts (such as hurricanes and floods). NCA5 instead focuses on evaluation of societal vulnerabilities (such as flood infrastructure, access to air conditioning, etc.), “Climate Action,” and policy recommendations with a social justice emphasis (Section 1.2).
- Overconfidence in conclusions and inadequate assessment of uncertainties (Section 3.1.5)
- Inadequate discrimination between natural and human-induced causes of trends and impacts (Chapter 7)
- Inadequate analysis of climate trends by relying on short time periods (Chapter 6)
- Uncritical evaluation of emission scenarios and climate model simulations in making projections for the next 25 to 100 years (Chapter 6; Section 3.2.1 and Chapter 5 of CWG25).

8.2 Adherence to the tenets of Gold Standard Science

With respect to the tenets of Gold Standard science listed in Section 1.2 of this report, we have identified the following major shortcomings in NCA5:

- **Lack of reproducibility.** In the few examples that we examined closely, we identified an instance where we could not reproduce the findings of the NCA5, a task that should require only rudimentary data analysis (Section 4.1)
- **Lack of transparency.** In many instances, the Traceable Account fails to justify the Key Finding. Metadata was not readily accessible. (Chapter 5)
- **Inadequate communication of error and uncertainty.** The Traceable Account for each Key Message provides a section on Major Uncertainties and Research Gaps; most of the accounts that we examined were superficial and uninformative. (Chapter 5)
- **Not skeptical of findings and assumptions.** The main text of the chapters is, with few exceptions, not skeptical of its findings and assumptions and does not mention dissent or disagreement. (Chapters 3 and 5)
- **Some hypotheses and Key Messages are not falsifiable.** Key Message 13.4 is but one of many examples: “Equitable Distribution of Transportation Trade-offs and Benefits Requires Community Involvement.”
- **Failure to acknowledge benefits** of warming and additional atmospheric CO₂ (CWG25 Section 2.1, Chapter 9)
- **Inadequacy of the peer review process.** The review of the NCA5 Third Order Draft by National Academies of Science, Engineering and Medicine (NASEM) identified some of the deficiencies we have noted, but the NCA5 authors were not obligated to adopt the NASEM recommendations. More importantly, we’ve identified many other deficiencies in NCA5; the NASEM review did not point them out and thus lacked the rigor expected of NASEM reports.

8.3 Suitability for informing Federal climate and energy policy

We assess that the selection and presentation of information in NCA5 makes it an unreliable basis for U.S. climate and energy policy making. For each of the elements of knowledge characterization suitable for risk management listed in Section 1.3, here are specific examples where NCA5 falls short:

- The degree to which the assumptions made are reasonable/realistic based on background knowledge
 - NCA5 focused on implausibly extreme scenarios for emissions and sea level rise and made policy recommendations without adequate consideration of the costs
- The degree to which data/information exists and are reliable and relevant
 - NCA5's unjustified assumptions about model reliability, and its use of short time periods for analysis, does not support its high-confidence conclusions
- The degree to which there is disagreement among experts, including those from different environments or academic fields
 - While NCA5 was an interdisciplinary effort, the concerns we have raised all point to a failure to canvass or communicate the full range of evidence, including data and research findings that speak against Key Messages.
- The degree to which the phenomena involved are understood and accurate models exist
 - NCA5 is not appropriately skeptical of the ability of climate models to attribute the causes of warming and extreme events or to project future climates, especially at the regional level
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns
 - A major NCA5 shortcoming is its dismissal of natural climate variability in many contexts where it should have been a major consideration

NCA5 is also problematic for informing policy because its exaggerated language promotes alarm and advocates for specific policies without a proper risk analysis. The NASEM Review of the NCA5 underscores the endemic nature of this problem - their review appears to be written by authors who share many of the biases of the NCA5 team, with an inordinate focus on social and policy issues. It is then not surprising that objectivity can suffer when climate scientists communicate their understanding to non-experts. Further, the field of climate science has been politicized by NetZero mandates. This lack of objectivity usurps the public's right to make informed choices and undermines their confidence in the scientific enterprise.

Philip Handler, President of the National Academy of Sciences, identified the problem forty-five years ago in an editorial that still resonates:

Difficulty arises in the scientific community from confusion of the role of scientist *qua* scientist with that of scientist as citizen, confusion of the ethical code of the scientist with the obligation of the citizen, blurring the distinction between intrinsically scientific and intrinsically political questions. When scientists fail to recognize these boundaries, their own ideological beliefs, usually unspoken, easily becloud seemingly scientific debate.

[ALTHOUGH I VERY MUCH LIKE THIS TEXT, I THINK WE SHOULD DELETE IT IN AN EFFORT TO REMAIN CIRCUMSPECT]

8.4 Recommendations for NCA6

While we have assessed NCA5 to be scientifically inadequate and unsuitable as a basis for decision-making, one can imagine a different National Climate Assessment that meets statutory and policy maker requirements. The goal should be not to persuade, but to impart understanding by being

objective, transparent and complete. A suitable NCA would be an important complement to IPCC assessments to the extent that its analysis and conclusions differ from the “consensus” of the IPCC reports and additional topics are addressed. Such a report would promote a more open scientific discussion and a more informed policy debate.

We recommend that the NCA6 have a narrower scope than NCA5, refocusing on climate science, including natural climate variability, with topics to include:

- How the climate has changed in the past. The U.S. has the best and longest meteorological records and they should be examined and displayed in their entirety. Trend analyses should include longest periods available and employ suitable statistical methods. Local paleoclimate data should be considered where available. Analysis should demonstrate not only how the climate has varied and changed, but also regional heterogeneity. Standard, easily understandable metrics should be employed.
- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future. The regional chapter for REGION that includes Texas only stated that SOMETHING MISSING HERE??
- A critical survey of current global and regional modeling capabilities and their suitability for regional impact assessments and projections. This would include an assessment of their ability to reproduce observed changes. It should also discuss alternative methods for generating projections and forecasts on regional and decadal scales, along the lines of Chapter 10 of the IPCC AR6 WGI Report.
- Assessment of the impacts of recent historical climate variability and change on ecosystems and society. Where long-term data indicate a detectable regional change, regional projections can be made for the period 2030-2050. Emissions scenarios exceeding RCP4.5/SSP2-4.5 and ECS values exceeding 4°C should not be used. Regional projections to 2100 have no credibility at this time.

It is important that climate projections be assessed in context of current science capabilities. The pressures toward spatially or temporally precise projections should be resisted as the current models are nowhere up to the task (an example is discussed in CWG25 Section 5.8). In that light, the many pages of NCA5 devoted to projected regional and sectoral impacts have little value.

Given the substantial deficiencies and bias in NCA5 that we have identified, producing an objective NCA6 report with the current NCA organizational construct would be a challenge. A NASEM review could help, but only if the selected participants reflect full viewpoint diversity and do not simply mirror the assumptions and biases of past NCA teams. We regard the CWG25 report to be a good start on NCA6 in terms of scope and objectivity, including adherence to the tenets of Gold Standard Science.

More broadly, we recommend a rewrite of the Global Change Research Act. The current mandate is vague and off point, allowing successive NCA teams to interpret the mandate as they see fit. Moreover, it is becoming increasingly clear that current and foreseeable models are not fit-for-purpose to describe regional climates, let alone usefully project them for 25 and 100 years. Further, the use of the term “global change” is ambiguous and outdated.

9 REFERENCES

- Aven, Terje (2017) "Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices," *Reliability Engineering & System Safety* 167 (November 2017): 42–48
<https://www.sciencedirect.com/science/article/pii/S0951832016306950>
- Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.
- Diffenbaugh, N.S., D. Singh, and J.S. Mankin, 2018: Unprecedented climate events: Historical changes, aspirational targets, and national commitments. *Science Advances*, 4 (2), 3354.
<https://doi.org/10.1126/sciadv.aao3354>
- Kirchmeier-Young, M.C. and X. Zhang, 2020: Human influence has intensified extreme precipitation in North America. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (24), 13308-13313. <https://doi.org/10.1073/pnas.1921628117>
- Knutson, Thomas and Fanrong Zeng (2018) "Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends" *Journal of Climate* 31(12) <https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml>
- National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/26757>.
- NCA4. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I* (D. J. Wuebbles, D. W. Fahey, and K. A. Hibbard, Eds.). U.S. Global Change Research Program.
<https://doi.org/10.7930/J0J964J6>
- NCA5. (2023). *Fifth National Climate Assessment* (A. R. Crimmins et al., Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023.CH1>
- Schlund, Manuel, Axel Lauer, Pierre Gentine, Steven C. Sherwood, and Veronika Eyring (2020) Emergent constraints on equilibrium climate sensitivity in CMIP5: do they hold for CMIP6? *Earth System Dynamics* 11 1233-1258 <https://doi.org/10.5194/esd-11-1233-2020>

10 APPENDIX: CHARGE TO THE REVIEW

ABOUT THE AUTHORS

[Insert updated bios]

From: Roy Spencer <roywspencer@hotmail.com>
Sent: Monday, July 14, 2025 4:29 PM
To: Steven Koonin
Cc: Judith Curry; Ross McKittrick; John Christy; Travis Fisher; Josh Loucks; Seth Cohen
Subject: RE: NCA5 progress

So, if most authors maintain that $2+2=5$, and we have the temerity to disagree, should we avoid being adversarial? Of course we are adversaries of conventional "wisdom". There is no way to avoid that without sounding squishy. Stand up for what we believe is the proper interpretation of the data.

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Steven Koonin <steven.koonin@gmail.com>
Date: 7/14/25 3:15 PM (GMT-06:00)
To: Roy Spencer <roywspencer@hotmail.com>
Cc: Judith Curry <curry.judith@gmail.com>, Ross McKittrick <ross.mckittrick@gmail.com>, John Christy <climateman60@gmail.com>, Travis Fisher <travis.scott.fisher@gmail.com>, Josh Loucks <loucksj14@gmail.com>, Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

Yes, of course. Just like school kids, it "believes" what it's been exposed to and can't "think" critically.

So I discount the comments on substance. But do give some credence to its comments on tone and framing.

Steven Koonin

On Jul 14, 2025, at 16:06, Roy Spencer <roywspencer@hotmail.com> wrote:

Isn't it true that AI models are going to survey the *conclusions* of published studies, even if the underlying analyses do not support those conclusions?

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Steven Koonin <steven.koonin@gmail.com>
Date: 7/14/25 1:17 PM (GMT-06:00)
To: 'Judith Curry' <curry.judith@gmail.com>, 'Ross McKittrick' <ross.mckittrick@gmail.com>
Cc: 'John Christy' <climatemanager60@gmail.com>, "'Roy W. Spencer'" <roywspencer@hotmail.com>, 'Travis Fisher' <travis.scott.fisher@gmail.com>, 'Josh Loucks' <loucksj14@gmail.com>, 'Seth Cohen' <seth.cohen@hq.doe.gov>
Subject: RE: NCA5 progress

Here's what COPilot has to say about Judy's desmarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

Scientific Accuracy

Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature

Category	Indicators
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review • Binary worldview: The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism. • Limited acknowledgment of uncertainty in contrarian claims: While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

Logical Coherence

Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

Summary Judgment

Dimension	Verdict
-----------	---------

Scientific Accuracy	Substantive methodological critiques, selective evidence base
---------------------	---

Tone	Adversarial and rhetorically charged
------	--------------------------------------

Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
------------------	---

Logical Coherence	Structured and readable, but occasionally editorial and circular
-------------------	--

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it’s shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry
<curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick
<ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4
 - my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different

version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

<image001.jpg>

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--

<image001.jpg>

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Monday, July 14, 2025 4:15 PM
To: Roy Spencer
Cc: Judith Curry; Ross McKittrick; John Christy; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Yes, of course. Just like school kids, it “believes” what it’s been exposed to and can’t “think” critically.

So I discount the comments on substance. But do give some credence to its comments on tone and framing.

Steven Koonin

On Jul 14, 2025, at 16:06, Roy Spencer <roywspencer@hotmail.com> wrote:

Isn't it true that AI models are going to survey the **conclusions** of published studies, even if the underlying analyses do not support those conclusions?

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Steven Koonin <steven.koonin@gmail.com>
Date: 7/14/25 1:17 PM (GMT-06:00)
To: 'Judith Curry' <curry.judith@gmail.com>, 'Ross McKittrick' <ross.mckittrick@gmail.com>
Cc: 'John Christy' <climatemanager60@gmail.com>, "Roy W. Spencer" <roywspencer@hotmail.com>, 'Travis Fisher' <travis.scott.fisher@gmail.com>, 'Josh Loucks' <loucksj14@gmail.com>, 'Seth Cohen' <seth.cohen@hq.doe.gov>
Subject: RE: NCA5 progress

Here’s what COPilot has to say about Judy’s desmarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

 Scientific Accuracy

 Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**

- Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
- Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

▲ Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

👤 Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

🗨️ Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review ● Binary worldview: The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism. ● Limited acknowledgment of uncertainty in contrarian claims: While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

🔄 Logical Coherence

✓ Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

▲ Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.

- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

★ Summary Judgment

Dimension Verdict

Scientific Accuracy Substantive methodological critiques, selective evidence base

Tone Adversarial and rhetorically charged

Bias and Framing Heavy reliance on contrarian sources; limited engagement with consensus science

Logical Coherence Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it’s shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can’t seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy
<climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry
<curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in

CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

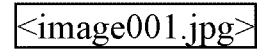
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

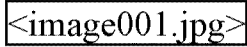
3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it

seems to have hallucinated about things we didn't even say.
Still, it points to the need to guard against snark.

--


Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--


Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Roy Spencer [roywspencer@hotmail.com]
Sent: 7/14/2025 8:06:25 PM
To: Steven Koonin [steven.koonin@gmail.com]; 'Judith Curry' [curry.judith@gmail.com]; 'Ross McKittrick' [ross.mckittrick@gmail.com]
CC: 'John Christy' [climateman60@gmail.com]; 'Travis Fisher' [travis.scott.fisher@gmail.com]; 'Josh Loucks' [loucksj14@gmail.com]; 'Seth Cohen' [seth.cohen@hq.doe.gov]
Subject: RE: NCA5 progress

Isn't it true that AI models are going to survey the *conclusions* of published studies, even if the underlying analyses do not support those conclusions?

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Steven Koonin <steven.koonin@gmail.com>
Date: 7/14/25 1:17 PM (GMT-06:00)
To: 'Judith Curry' <curry.judith@gmail.com>, 'Ross McKittrick' <ross.mckittrick@gmail.com>
Cc: 'John Christy' <climateman60@gmail.com>, "Roy W. Spencer" <roywspencer@hotmail.com>, 'Travis Fisher' <travis.scott.fisher@gmail.com>, 'Josh Loucks' <loucksj14@gmail.com>, 'Seth Cohen' <seth.cohen@hq.doe.gov>
Subject: RE: NCA5 progress

Here's what COPilot has to say about Judy's desnarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

□ Scientific Accuracy

☑ Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

⚠ Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
 - **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
 - **Model criticisms overgeneralized:** Claims that current models are "not fit-for-purpose" for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.
-

□ Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

易 Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review

- **Binary worldview:** The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism.
- **Limited acknowledgment of uncertainty in contrarian claims:** While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

□ Logical Coherence

☑ Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

⚠ Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

□ Summary Judgment

Dimension	Verdict
Scientific Accuracy	Substantive methodological critiques, selective evidence base
Tone	Adversarial and rhetorically charged
Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
Logical Coherence	Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it’s shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer

<roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

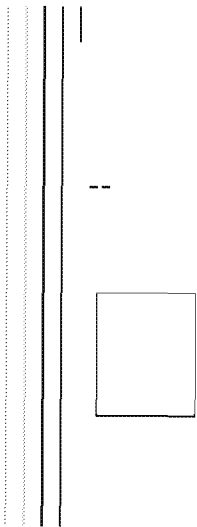
- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

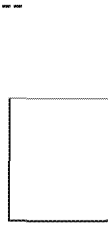
- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Roy Spencer <roywspencer@hotmail.com>
Sent: Monday, July 14, 2025 3:52 PM
To: John Christy; Judith Curry
Cc: Steven Koonin; Ross McKittrick; Travis Fisher; Josh Loucks; Seth Cohen
Subject: RE: NCA5 progress

Did anyone see this from a couple weeks ago... AI lying and manipulating the questioner. Pretty disturbing, but like John says, LLMs have a pretty messed up version of reality from which to learn.
<https://fortune.com/2025/06/29/ai-lies-schemes-threats-stress-testing-claude-openai-chatgpt/>

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: John Christy <climateman60@gmail.com>
Date: 7/14/25 2:25 PM (GMT-06:00)
To: Judith Curry <curry.judith@gmail.com>
Cc: Steven Koonin <steven.koonin@gmail.com>, Ross McKittrick <ross.mckittrick@gmail.com>, "Roy W. Spencer" <roywspencer@hotmail.com>, Travis Fisher <travis.scott.fisher@gmail.com>, Josh Loucks <loucksj14@gmail.com>, Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

It seems to me that if CoPilot swims in a pool with lots of chaff and little wheat, it will be convinced that the chaff must be considered valid and therefore is unable to discern the correctness of arguments against the chaff. Included in the chaff are volumes of negative assertions against Ross, Roger, me etc. (don't know why Steve, Roy and Judy were left out.), so it assumes our contributions are suspect. Overall I think this exercise is quite valuable but it needs real humans to provide some adult supervision.

John C.

On Mon, Jul 14, 2025 at 1:23 PM Judith Curry <curry.judith@gmail.com> wrote:
Not clear what is meant by editorializing?

On Mon, Jul 14, 2025 at 11:17 AM Steven Koonin <steven.koonin@gmail.com> wrote:

Here's what COPilot has to say about Judy's desmarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

Scientific Accuracy

Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review

- **Binary worldview:** The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism.

- **Limited acknowledgment of uncertainty in contrarian claims:** While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

🔗 Logical Coherence

✅ Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

▲ Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

✦ Summary Judgment

Dimension	Verdict
Scientific Accuracy	Substantive methodological critiques, selective evidence base
Tone	Adversarial and rhetorically charged
Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
Logical Coherence	Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it’s shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it

would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA

curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



--
Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: John Christy [climateman60@gmail.com]
Sent: 7/14/2025 7:25:12 PM
To: Judith Curry [curry.judith@gmail.com]
CC: Steven Koonin [steven.koonin@gmail.com]; Ross McKittrick [ross.mckittrick@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress
Attachments: image001.jpg

It seems to me that if CoPilot swims in a pool with lots of chaff and little wheat, it will be convinced that the chaff must be considered valid and therefore is unable to discern the correctness of arguments against the chaff. Included in the chaff are volumes of negative assertions against Ross, Roger, me etc. (don't know why Steve, Roy and Judy were left out.), so it assumes our contributions are suspect. Overall I think this exercise is quite valuable but it needs real humans to provide some adult supervision.

John C.

On Mon, Jul 14, 2025 at 1:23 PM Judith Curry <curry.judith@gmail.com> wrote:
Not clear what is meant by editorializing?

On Mon, Jul 14, 2025 at 11:17 AM Steven Koonin <steven.koonin@gmail.com> wrote:
Here's what COPilot has to say about Judy's desnarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

Scientific Accuracy

Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
 - **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
 - **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.
-

Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5’s alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review

- **Binary worldview:** The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism.
- **Limited acknowledgment of uncertainty in contrarian claims:** While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

Logical Coherence

Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

Summary Judgment

Dimension	Verdict
Scientific Accuracy	Substantive methodological critiques, selective evidence base

Dimension	Verdict
Tone	Adversarial and rhetorically charged
Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
Logical Coherence	Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it's shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>
Sent: Sunday, July 13, 2025 3:12 PM
To: Ross McKittrick <ross.mckitrick@gmail.com>
Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:
Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckitrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

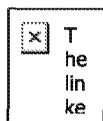


--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Monday, July 14, 2025 2:23 PM
To: Steven Koonin
Cc: Ross McKittrick; John Christy; Roy W. Spencer; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Not clear what is meant by editorializing?

On Mon, Jul 14, 2025 at 11:17 AM Steven Koonin <steven.koonin@gmail.com> wrote:

Here's what COPilot has to say about Judy's desnarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

Scientific Accuracy

Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

🗨️ Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review

- **Binary worldview:** The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism.
- **Limited acknowledgment of uncertainty in contrarian claims:** While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

🔗 Logical Coherence

✅ Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

▲ Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

🔗 Summary Judgment

Dimension	Verdict
Scientific Accuracy	Substantive methodological critiques, selective evidence base

Dimension	Verdict
Tone	Adversarial and rhetorically charged
Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
Logical Coherence	Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it's shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>
Sent: Sunday, July 13, 2025 3:12 PM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

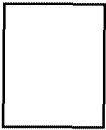
3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/14/2025 6:22:25 PM
To: Steven Koonin [steven.koonin@gmail.com]
CC: Ross McKittrick [ross.mckittrick@gmail.com]; John Christy [climatemanager60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

Steve, thanks for doing that. I thought i had taken out young scientists trying to save the planet? Also we might consider removing Pielke Jr's quote re "scientific malpractice"

On Mon, Jul 14, 2025 at 11:17 AM Steven Koonin <steven.koonin@gmail.com> wrote:

Here's what COPilot has to say about Judy's desmarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

Scientific Accuracy

Strengths

- **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

Limitations

- **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

Tone

- **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.

- **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

Bias and Framing

Category	Indicators
Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review

- **Binary worldview:** The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism.
- **Limited acknowledgment of uncertainty in contrarian claims:** While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

Logical Coherence

Internal Structure

- Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

Coherence Gaps

- **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

Summary Judgment

Dimension	Verdict
Scientific Accuracy	Substantive methodological critiques, selective evidence base
Tone	Adversarial and rhetorically charged
Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science

Dimension**Verdict**

Logical Coherence

Structured and readable, but occasionally editorial and circular

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it's shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

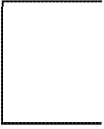
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Monday, July 14, 2025 2:17 PM
To: 'Judith Curry'; 'Ross McKittrick'
Cc: 'John Christy'; 'Roy W. Spencer'; 'Travis Fisher'; 'Josh Loucks'; 'Seth Cohen'
Subject: RE: NCA5 progress
Attachments: image001.jpg

Here's what COPilot has to say about Judy's desnarked version:

Here's a structured analysis of the **NCA5 Review** document (authored by Judith Curry and colleagues), focusing on four key dimensions: **scientific accuracy**, **tone**, **bias**, and **logical coherence**.

• Scientific Accuracy

✓ Strengths

- ? **Valid critiques of model sensitivity and emissions scenarios:** The report raises legitimate concerns about the plausibility of SSP5-8.5 and excessive reliance on high-end sea level projections. These reflect ongoing debates in the literature and are grounded in methodological caution.
- ? **Methodological concerns are substantive:**
 - Inconsistencies in time-series analysis and selective baselines (e.g. 1958 vs 1901) are rightly flagged as a statistical pitfall.
 - Emergent constraints critique aligns with studies (e.g. Schlund et al., 2020) that caution against overinterpreting spurious correlations.
- ? **Challenges attribution simplifications:** Points to cases where NCA5 presents strong attribution claims without robust methodological explanation—particularly on precipitation and heatwaves.

▲ Limitations

- ? **Some critiques rely on selective counter-literature:** While the report references CWG25 and contrarian scientists (e.g. McKittrick, Christy, Pielke Jr.), it underrepresents the broader consensus literature and fails to engage with rebuttals to those views.
- ? **Reproduction failures lack detail:** When stating inability to replicate NCA5's findings, such as trends in precipitation, the methodology is referenced but not fully shown—limiting reproducibility of the critique itself.
- ? **Model criticisms overgeneralized:** Claims that current models are “not fit-for-purpose” for long-term regional projections ignore recent advancements in downscaling, probabilistic framing, and multi-model ensembles.

Tone

- ? **Formal but adversarial:** The report maintains a professional structure but frequently uses language that characterizes NCA5 as biased, ideological, or propagandistic (e.g., “hyperbolic advocacy,” “activist tone,” “naïve and simplistic”).
- ? **Occasional rhetorical overreach:** Phrases like “scientific malpractice,” “usurps the public’s right to informed choice,” or citing 1970s-era editorials suggest a broader normative agenda beyond empirical review.
- ? **Dismissive of policy framing:** The critique is sharply opposed to NCA5’s social justice themes and policy recommendations, labeling them extraneous or political, rather than engaging with their empirical basis (e.g., equity in heat exposure).

易 Bias and Framing

Category	Indicators
----------	------------

Source Selection	Prioritizes CWG25, skeptics of consensus science; under-cites mainstream climate literature
------------------	---

Category	Indicators
Framing Strategy	Positions CWG25 as scientific corrective to NCA5's alleged ideological bias
Motive Attribution	Suggests mainstream climate scientists are motivated by fear, activism, or political mandates
Language Use	Uses emotionally and politically charged terms in what is framed as a scientific review ? Binary worldview: The document tends to frame climate discourse as either “Gold Standard Science” or ideological overreach, leaving limited room for middle-ground scientific pluralism. ? Limited acknowledgment of uncertainty in contrarian claims: While NCA5’s uncertainties are dissected in detail, competing claims (e.g., about historical heatwaves or CO₂ fertilization benefits) are presented with stronger rhetorical conviction and minimal caveats.

• Logical Coherence

✓ Internal Structure

- ? Well-organized chapters with clear progression:
 - From systemic critique (e.g., peer review process, overconfidence) to granular examples (e.g., precipitation trends, heatwave framing).
 - Inclusion of references, appendices, and traceability comments reinforces formal review tone.

▲ Coherence Gaps

- ? **Circular referencing:** The report repeatedly relies on CWG25 to corroborate its claims, creating a loop rather than triangulating with independent peer-reviewed sources.
- ? **Generalizations from anecdotes:** Statements about young scientists “trying to save the planet” or critiques of NCA5’s cover image veer into editorial territory and dilute the analytical focus.
- ? **Recommendations blend science and policy ideology:** Calls to rewrite the Global Change Research Act or eliminate regional climate projections are rooted more in philosophical disagreement than scientific infeasibility.

• Summary Judgment

Dimension	Verdict
-----------	---------

Scientific Accuracy	Substantive methodological critiques, selective evidence base
---------------------	---

Tone	Adversarial and rhetorically charged
------	--------------------------------------

Bias and Framing	Heavy reliance on contrarian sources; limited engagement with consensus science
------------------	---

Logical Coherence	Structured and readable, but occasionally editorial and circular
-------------------	--

This is a technically informed but ideologically framed critique. It raises valid concerns about uncertainty treatment, scenario realism, and statistical rigor in NCA5—but it’s shaped by a strong counter-narrative lens. Its scientific merit would be strengthened by more diverse sourcing, clearer separation of analysis and editorialism, and a broader epistemic perspective.

From: Judith Curry <curry.judith@gmail.com>

Sent: Sunday, July 13, 2025 3:12 PM

To: Ross McKittrick <ross.mckitrick@gmail.com>

Cc: Steven Koonin <steven.koonin@gmail.com>; John Christy <climateman60@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

see attached for a shorter, desnarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>

Sent: Friday, July 11, 2025 3:49 PM

To: John Christy <climateman60@gmail.com>

Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>

Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: John Christy <climateman60@gmail.com>
Sent: Sunday, July 13, 2025 8:36 PM
To: Judith Curry
Cc: Ross McKittrick; Steve Koonin; Roy W. Spencer; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Judy

I like this tighter version of NCA5 a lot. However, one key point - it leaves the reader thinking NCA4 was praiseworthy regarding heat events when in fact it clearly promoted falsehoods in its Executive Summary (as described in early section 1.4). I think we need to expose NCA4's egregious use of data to remind the reader that the content/review problem has a lot of inertia. As mentioned earlier, it could be a simple one line in the section 4.2 perhaps bottom of your page 12 or somewhere on page 13, "However, while describing heat extremes well in one portion of the report, NCA4's Executive Summary was deceptive in documenting these extremes as described in the supplementary material xxxxx".

I'm well aware of this NCA4 figure ES.5 because Nancy Pelosi almost shoved it in my face at a House hearing and then did the usual politician-closer "I yield back my time Mr. Chairman" and shut off my ability to respond leaving everyone with the idea record highs were increasing. It was also used in the Montana case for example. Meehl's work is still being cited here and there in the literature. So, there are a number of reasons for documenting the deception of NCA4's ES.5 in the official record somewhere since it has seen wide exposure, and putting it in a review of NCA would be appropriate in my humble opinion.

Link to new precipitation analysis used in NCA5 Review (expanded from CWG)

https://www.nsstc.uah.edu/data/ushcn_jrc/SI.Precipt_trends_reproducing.pdf

Travis:

Is there a way to put extra documents/datasets on a DoE website for public access? Sending folks to my uah.edu directory looks a little bush-league.

John C.

John Christy
Director, Earth System Science Center
Professor, Atmos and Earth Science
Alabama State Climatologist
The University of Alabama in Huntsville
climateman60@gmail.com

On Jul 13, 2025, at 2:12 PM, Judith Curry <curry.judith@gmail.com> wrote:

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy
<climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry
<curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more

of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick
<ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to

explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--

<~WRD0003.jpg>

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

<NCA5Review Curry.docx>

From: Judith Curry [curry.judith@gmail.com]
Sent: 7/13/2025 7:12:20 PM
To: Ross McKittrick [ross.mckittrick@gmail.com]
CC: Steven Koonin [steven.koonin@gmail.com]; John Christy [climateman60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress
Attachments: NCA5Review Curry.docx

see attached for a shorter, desmarked version of NCA5 for you to consider. I didn't do track changes, its clean text

On Sun, Jul 13, 2025 at 10:55 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

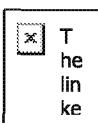
--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--

Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>



Critique of the Fifth National Climate Assessment

EXECUTIVE SUMMARY	3
1 INTRODUCTION	4
1.1 ABOUT THIS REPORT	4
1.2 ABOUT THE NATIONAL CLIMATE ASSESSMENTS	4
1.3 STANDARDS FOR ASSESSING NCA PRODUCTS	5
1.4 WHEN PEER REVIEW FAILED	ERROR! BOOKMARK NOT DEFINED.
2 NCA5 OVERVIEW CHAPTER: HYPERBOLIC ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE.....	6
3 OVERCONFIDENCE WHEN STATING CONCLUSIONS	7
3.1 INFLATED CERTAINTY LEVELS	7
3.2 OVERSTATING FINDINGS IN UNDERLYING SOURCES	9
3.3 TECHNICAL EXAMPLE: EMERGENT CONSTRAINTS	9
4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS.....	10
4.1 AVERAGE AND EXTREME PRECIPITATION.....	11
4.2 HEATWAVES.....	11
5 INADEQUATE TRACEABLE ACCOUNTS.....	14
6 OVEREMPHASIS ON EXTREME SCENARIOS	16
7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES	18
8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6.....	19
8.1 COMPLIANCE WITH USGCRP'S STATUTORY OBLIGATION	19
8.2 ADHERENCE TO THE TENETS OF GOLD STANDARD SCIENCE	20
8.3 SUITABILITY FOR INFORMING FEDERAL CLIMATE AND ENERGY POLICY	20
8.4 RECOMMENDATIONS FOR NCA6.....	21
9 REFERENCES	22
APPENDICES.....	24
APPENDIX 1: CHARGE TO THE REVIEW	24
ABOUT THE AUTHORS.....	25

EXECUTIVE SUMMARY

This report critically evaluates the Fifth National Climate Assessment (NCA5), finding it an inadequate basis for climate and energy policies. A detailed review of the foundational chapters on climate science raises several key concerns:

Scientific Integrity

- An advocacy tone, particularly in the Overview chapter, that is inconsistent with scientific objectivity
- Framing climate as a morality play
- Endemic overconfidence when stating conclusions, including inflated certainty levels and overstatement of findings from underlying sources
- No mentions of dissent, disagreement, controversies, or tradeoffs

Flawed methodology

- Minimal discussion of observational inadequacies
- Use of short time periods for trend analyses; more generally lack of a consistent rule for choosing time scales
- Attribution is implied, not dissected
- Overemphasis on extreme scenarios for future emissions and sea level rise
- Inadequate traceable accounts to support key conclusions

Inadequate Review Process

- A review by the National Academy of Sciences, Engineering, and Medicine (NASEM) failed to challenge some fundamental flaws in NCA5
- The NCA5 authors failed to adopt some improvements recommended by NASEM

The report shows NCA5 to be a biased and incomplete picture of climate science that skews toward excessive climate risk. Consequently, NCA5 should not be used as basis for climate and energy policies.

Motivated optimism with an advocacy tone

Subtle advocacy with emphasis

Attribution is implied, not dissected

Framing climate as a morality play

Dissent is invisible

Minimal discussion of observational limitations

No mention of tradeoffs

1 INTRODUCTION

1.1 About this Report

This report responds to a request from the Office of Science and Technology Policy (OSTP) Director Michael Kratsios (reproduced in Appendix 1) that we assess the suitability of the Fifth National Climate Assessment (NCA5 2023) for informing climate and energy policies.

To conduct this assessment, we reviewed NCA5 itself, the National Academies of Science, Engineering and Medicine (NASEM) review of the Third Order NCA5 Draft, and the USGCRP responses to that review. We have drawn upon our long experience working on advisory reports, including for the NASEM, the Intergovernmental Panel on Climate Change (IPCC) and other organizations, as writers, reviewers and study leaders.

We find that NCA5 should not be relied on for policy making as it is an incomplete and misleading picture of our understanding of the changing climate and the risks it poses to the nation. NCA5 was selective and incomplete in its survey of climate science. Further, we have reviewed recent scientific developments in a separate report to Energy Secretary Wright (Climate Working Group 2025, herein denoted “CWG25”). The overall effect of the biases and omissions of NCA5 is an excessively dire picture of climate risk.

To support our finding, the following sections of this chapter provide some background on the National Climate Assessments and the standards by which we have assessed NCA5. Chapters 2 through 7 detail important ways in which NCA5 fails to meet those standards. Finally, Chapter 8 summarizes our evaluation of NCA5 and makes recommendations for NCA6.

1.2 About the National Climate Assessments

The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to develop and coordinate “a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.”

The National Climate Assessment (NCA) Reports evolved from the GCRA requirement to:

Prepare and submit to the President and the Congress an assessment which (1) integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings; (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

The five NCA Reports to date have interpreted this mandate in different ways:

- NCA1 (2000) was a multidisciplinary effort to study and portray in regional detail the potential effects of human-induced global warming on the United States.

- NCA2 (2009) was a relatively short report that not only focused on the potential consequences of climate change but also sought to identify potential adaptation measures and identify the highest priorities for future research.
- NCA3 (2014) was an expanded effort that continued along the lines of NCA2, and was distinguished by a comprehensive review process, including a review by the National Academy of Sciences. NCA3 introduced a traceability analysis for each key finding, including a description of uncertainties.
- NCA4 (2017/2018) was a further expanded effort that was published in two volumes: I Climate Science Special Report (CSSR), and II Impacts, Risk, and Adaptation in the United States. This was the first NCA report to devote significant effort to assessing climate science.
- NCA5 (2023) returned to a single volume format, reducing discussion of climate science to a cursory two chapters, with continuing focus on regional and sectoral impacts of climate change. NCA5 expanded its remit to topics that are arguably outside the purview of the USGCRP, focusing on “Climate Action” and policy recommendations with a social justice emphasis.

These successive interpretations of the NCA are poorly aligned with the GCRA’s statutory requirements. Only NCA4 gives serious consideration to climate science, which receives the great majority of USGCRP funding, and even then NCA4 misrepresents some important points. Natural climate variability is essentially dismissed as unimportant in NCA4 and barely mentioned in NCA5 in most contexts, despite the mandate to include both human-caused and natural climate change. Most significantly, NCA5 has redirected the focus away from climate science and even the hazard elements of impacts, towards evaluation of societal vulnerabilities and advocacy for particular policy options, especially deployment of wind and solar power generation.

1.3 Standards for Assessing NCA Products

Beyond the statutory requirements stated above, another pertinent standard is President Trump’s executive order of May 23, 2025, Restoring Gold Standard Science. It enumerates some of the characteristics of good science, namely that it should be:

- i. reproducible;
- ii. transparent;
- iii. communicative of error and uncertainty;
- iv. collaborative and interdisciplinary;
- v. skeptical of its findings and assumptions;
- vi. structured for falsifiability of hypotheses;
- vii. subject to unbiased peer review;
- viii. accepting of negative results as positive outcomes; and
- ix. without conflicts of interest.

For an assessment of policy relevant science, it is also important to include statements about the strength of knowledge. The IPCC’s approach to assessing strength of knowledge is based on judgment of the available evidence and agreement among experts. But there are more sophisticated knowledge characterizations for risk management. Here are the elements according to Aven (2017):

- The degree to which the assumptions made are reasonable/realistic based on background knowledge

- The degree to which data/information exists and are reliable and relevant
- The degree to which there is disagreement among experts (including those from different environments or academic fields)
- The degree to which the phenomena involved are understood and accurate models exist
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns (issues that are known to matter but are ignored, such as, in this context, natural variability).

2 NCA5 OVERVIEW CHAPTER: ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE

NCA5 Chapter 1, “Overview”, holds a prominent place in the Report since it summarizes the entire report and is the only section that many will read. Chapter 1 is marred by an activist tone, language that aggressively promotes mitigation policies, and motivated optimism. As such, this chapter adds an imprimatur of scientific authority to naïve and simplistic declarations of opinion about public policy. Some examples are presented here.

Chapter 1 opens as follows:

The more the planet warms, the greater the impacts. Without rapid and deep reductions in global greenhouse gas emissions from human activities, the risks of accelerating sea level rise, intensifying extreme weather, and other harmful climate impacts will continue to grow. Each additional increment of warming is expected to lead to more damage and greater economic losses compared to previous increments of warming, while the risk of catastrophic or unforeseen consequences also increases.

This statement presupposes that all warming is anthropogenic, that all warming is bad and causes economic damage, and that warming intensifies extreme weather. Such sweeping generalizations go well beyond what science has or can establish. The statement also refers to growing risks without reference to their magnitude – a small risk that grows may still be a small risk, and a large risk may be only incrementally worsened.

On the next page the Overview states:

Each additional increment of warming leads to greater risks [here it lists 7 key components of society including food security and the economy]... Without deeper cuts in global net emissions, climate risks to the US will continue to grow... Action to limit future warming and reduce risks can have near-term benefits and opportunities: low-carbon energy jobs, Improved air quality, Health benefits, Economic benefits...”

The authors write as if climate policy does not involve trade-offs and all measures to reduce future warming will be effective and beneficial. Neither the vast body of scholarship on climate science and economics, nor historical experience, support such simplistic claims (CWG25). Not every additional increment of warming leads to economic harms; in fact, NCA5 Chapter 19 acknowledges that there will also be benefits. Nor is climate policy guaranteed to benefit the economy; it could impose net costs. Such misleading statements are a disservice to policymakers.

Pages 8 and 9 of the Overview promote renewable energy options by noting, correctly, that the levelized costs of wind/solar generation have fallen sharply since 2010, and so offers this rationale for pursuing deep emission reductions:

Recent growth in the capacities of wind, solar, and battery storage technologies is supported by rapidly falling costs of zero- and low-carbon energy technologies, which can support even deeper emissions reductions. For example, wind and solar energy costs dropped 70% and 90%, respectively, over the last decade, while 80% of new generation capacity in 2020 came from renewable sources.

Yet it has long been known that intermittent renewables generation must be supplemented by dispatchable generation to meet grid reliability standards, and that doing so (e.g., through natural gas, fission, or storage) significantly increases the cost of electricity. Further, there are yet unmet synchronization challenges in electrical grids with heavy penetration of wind and solar generation. NCA5 fails to acknowledge these facts. But more importantly, we see no reason for NCA5 to be discussing renewable energy technologies and economics in the context of its mandate.

Page 17 of the Overview introduces the discussion of risks from extreme weather events by saying “Harmful impacts from more frequent and severe extremes are increasing across the country.” This creates the impression that extreme weather events are worsening and that disaster losses are driven by trends in extreme weather. While the section goes on to acknowledge that some of the increase is due to increases in the exposure and value of assets at risk, it then invokes the NOAA Billion Dollar Dataset as evidence of extreme weather getting worse. Scientists have shown that this is an invalid metric (CWG2025 Section 10.2) since it measures the growth of the economy not the frequency of extreme weather, and indeed NOAA has recently withdrawn the data product. Even though the dataset was still distributed by NOAA at the time of the NCA5, the report authors failed to assess it skeptically and see that it was unfit for the purpose of measuring climate trends.

Page 23 of the Overview states, in large font:

Climate changes are making it harder to maintain safe homes and healthy families; reliable public services; a sustainable economy; thriving ecosystems, cultures, and traditions; and strong communities.

It is pointless to try to evaluate this statement on scholarly grounds. This kind of language doesn’t belong in a scientific assessment report. Its prominent inclusion points not only to the willingness of NCA5 authors to promote alarm, but also the ineffectiveness of the review process in eliminating such statements.

3 OVERCONFIDENCE WHEN STATING CONCLUSIONS

3.1 Inflated certainty levels

Overconfidence in stating conclusions has been an endemic problem in NCA Reports. The authors frequently make sweeping generalizations without appropriate caveats or acknowledging uncertainties. The overconfidence begins with inflated language to describe certainty levels.

NCA5 uses specific terms to convey information about scientific confidence associated with important finds, observations and projections. The Front Matter of NCA5 states that

confidence in a finding is based on the type, amount, quality, strength, and consistency of evidence; the skill, range, and consistency of methods to detect, evaluate, attribute, and interpret climate trends; and the degree of agreement across scientific information sources.

Table 1 from the Front Matter provides calibrated language for confidence assessment:

Very high:	Strong evidence (established theory, multiple sources, well documented and accepted methods, etc.). High consensus
High:	Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.). Medium consensus
Medium:	Suggestive evidence (a few sources, limited consistency, methods emerging, etc.) Competing schools of thought.
Low:	Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.). Disagreement or lack of opinions among experts.

This terminology is obviously inflated: *high confidence* with just moderate evidence and medium consensus; *medium confidence* with only suggestive evidence and competing schools of thought. This inflation in terminology leads to overconfidence in conclusions.

Even with this inflated terminology, NCA5 further inflates the confidence level of many of its conclusions to well beyond what the IPCC has concluded with more thorough justification, and by incorrectly applying its own standards. An example is the conclusion about anthropogenic influence on climate change, arguably one of the most important scientific statements of the report.

Key Message 3.1 Traceable Account states:

There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have unequivocally caused *all* global warming observed over the industrial era.

while the corresponding statements from IPCC AR5 and AR6 are

AR5: It is *extremely likely* that *more than half* of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. (IPCC, 2013)

AR6: The *likely* range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C. It is *likely* that well-mixed GHGs contributed a warming of 1.0°C to 2.0°C, other human drivers (principally aerosols) contributed a cooling of 0.0°C to 0.8°C, natural drivers changed global surface temperature by –0.1°C to +0.1°C, and internal variability changed it by –0.2°C to +0.2°C. It is *very likely* that well-mixed GHGs were the main driver of tropospheric warming since 1979.

The IPCC AR5 and AR6 statements provide likelihood assessments but not a confidence level. While NCA5 claims with *very high confidence* that fossil fuels have unequivocally caused *all* global warming, AR5 refers to “*more than half* of the observed warming” and AR6 provides a more nuanced statement that relates to a *likely* range of warming contributed to by human drivers.

3.2 Overstating findings in underlying sources

Although we did not do a detailed audit of NCA5's use of source material, spot checks suggest a pattern of overstatement.

Chapter 2 page 11 reports on an increase in precipitation in some areas and attributes it to "climate change":

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

NCA5 attributes the claim to Knutson and Zeng (2018). But Knutson and Zeng did not say these things nor did they analyze this particular period. For 1981-2010 they cautioned that observed changes are consistent with natural variability, and they did not claim attributable trends were observed over the United States.

As another example of overstating findings, NCA5's Chapter 2 page 18 states

There is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US.

This is apparently attributed to Diffenbaugh *et al.* (2018) and Kirchmeier-Young and Zhang (2020). Diffenbaugh *et al.* presented ratios of observed occurrences of extreme events to simulated occurrence rates in CMIP6 models run with only natural forcings. They report that for 79% of the U.S., extreme rainfall events are currently more frequent than in simulations, and the ratio of occurrences will rise under future warming simulations. This is not "robust" evidence of anthropogenic influence since it requires readers to assume that climate models accurately simulate regional precipitation patterns, something that the IPCC AR6 states is uncertain (AR6 WGI SPM Box SPM 1.2, SPM Section C.1.3).

Kirchmeier-Young and Zhang used three global climate models to analyze extreme 1- and 5-day events in North America. They noted large differences among the three models in their simulated precipitation changes, and two of the three models failed to yield attribution for 5-day events for the North America mean. In other words, the models disagreed on whether the observed changes were anthropogenic. Both of the cited references utilized the implausible RCP8.5 scenario (Chapter 6 of this Report) and began their "historical" observational records only in 1961. Here again this is not "robust" evidence, it is merely suggestive, particularly since other studies have found natural variability to be predominant.

3.3 Example: Emergent constraints

Some of the overconfidence expressed by NCA5 arises by omitting discussion of counterevidence in the peer reviewed literature, ignoring dissent and disagreement. An example is the topic of "emergent constraints". NCA5 Chapter 3 page 17 invokes this concept to support its claim that key uncertainties in climate model projections have been reduced:

An approach to reduce uncertainty in climate change projections has matured over the past decade. It is known as "emergent constraints." The term refers to strong statistical relationships between highly uncertain future climate parameters and observable trends or variations in the current climate, along with a physical explanation of this relationship.

Emergent constraints appeared in the climate modeling literature as an attempt to tie climate model behavior to climate observations in hopes of generating insight into real-world equilibrium climate sensitivity to a doubling of carbon dioxide (ECS). Climate models exhibit a wide range of ECS values. The idea of emergent constraints is to examine whether the models with shared sensitivity values also share a common representation of some climate process (usually related to clouds) that might influence ECS. Suppose, for instance, that in low-ECS models the total cloud fraction in the tropics is strongly correlated with that in the southern midlatitudes, but in high-ECS models the correlation is weak. Then researchers could examine whether the observed correlation is strong or weak and draw a conclusion about which type of model, and therefore which ECS value, is more likely.

A problem in the emergent constraint literature is that there has been a proliferation of proposed correlations with little physical motivation. NCA5 alludes to this in the Traceable Accounts section (p. 3-40) but not in the main Chapter text. As shown by Schlund *et al.* (2020) many emergent constraints patterned on CMIP5 models (Coupled Model Intercomparison Project No. 5, used for the IPCC 5th Assessment Report) failed to work on CMIP6 models (used for the IPCC 6th Assessment Report). In other words, the observed correlations in CMIP5 models between ECS and cloud processes failed to show up in CMIP6 models, indicating that they were likely spurious rather than clues to physical processes governing the climate system. As a result, emergent constraints estimated on CMIP5 models *increased* the uncertainty of ECS, rather than decreasing it as intended and as claimed by NCA5.

Yet NCA5 described the use of emergent constraint analysis as an advance that reduced uncertainty of ECS and climate model projections (p. 3-38):

Emergent constraints have been widely applied to reduce the simulated spread in the climate feedbacks that shape climate sensitivity.

4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS

CWG25 Chapter 6 discussed the need for care in the choice of time scale when making claims about trends in extreme weather. We provided examples from analysis of river flooding, heatwaves, and extreme precipitation to show how assertions about apparent trends based on short data sets fall apart when looking at longer versions of the same data sets. NCA5 uses varying time periods for trend analyses, especially in Chapter 2 (which is focused on trends), without explaining why shorter or longer intervals were chosen. For example, page 2-4 defines temperature trends with respect to the interval since the late 1800s whereas page 3-29 presents temperature trends over 1972-2021. Page 2-11 compares rainfall over the 2002-21 versus 1901-1960 intervals while page 2-18 uses the interval since the late 1950s to compute trends.

A further problem is that NCA5 uses term "trend" repeatedly without indicating if it is statistically significant (*i.e.* distinguishable from random variability); the ambiguity creates the impression all the observed changes were significant, but readers are left to speculate. All climate variables will, in principle, drift up or down over any particular time interval. Identifying the change as a trend

requires showing that it is statistically significant using a variance estimator suitable for the type of data being analysed. Of particular importance is choosing a method robust to serial correlation which is frequently present in climate data. Throughout Chapters 1 to 3, references are made to “trends” without explaining how they were computed. The exception was on page 1-19 which refers to urban temperature trends being calculated using the Theil-Sen estimator, although that method does not seem to have been used elsewhere. The one case where reference is made to statistical significance was on Page 2-9 referring to a trend in Atmospheric Optical Depth, but no explanation is given of how significance was determined. Page 2-19 refers to regional trends in droughts being “robust” but again fails to explain how the term was defined.

In this chapter when we refer to calculation of trends in precipitation, we use ordinary least squares to compute the linear trend over the entire sample length and we use the Vogelsang and Franses (2007) variance estimator which is robust to general forms of serial correlation.

4.1 Average and Extreme Precipitation

CWG25 Section 6.4 we presented analyses of updated data for the same locations (and many others), in all cases finding both considerable regional heterogeneity and that trends detectable on one time scale are often not detected on longer or shorter time scales. These findings argue against simple attribution of changes to anthropogenic influences.

NCA5 did not continue the NCA4 precedent of using the post-1901 interval as the time scale for its precipitation discussion. Instead it refers to changes “since the 1950s”; NCA5 Figure 2.8 suggests 1958 might be the intended start date. Under Key Message 2.2 “Extreme Events Are Becoming More Frequent and Severe” (p. 2-16) NCA5 states (p. 2-18):

Rainfall is becoming more extreme
Since the 1950s, there has been an upward trend in heavy precipitation across the contiguous US. This increase is driven largely by more frequent precipitation extremes, with relatively smaller changes in their intensity.

In addition to our concerns that inferences about trends are contingent on choice of time scale, if the intended meaning of this statement is that positive and significant trends are found in heavy precipitation events across CONUS we cannot reproduce it. Details of our analysis can be found at [LINK TO BRIEF WRITEUP ON THIS](#) can we just reference CWG HERE

Based upon our analysis, the following is a more accurate summary of what U.S. precipitation data show.

There are regionally heterogeneous changes in average and extreme precipitation. Positive trends in annual average rainfall and extreme events (defined either as the annual maximum or the number of exceedances of the 99th percentile value) are generally weak or non-existent when looking at samples exceeding 130 years in length. Significant trends can be found when beginning the sample in the 1950s although in most cases the trends weaken and become insignificant when looking at the post-1980 interval. This argues against attribution of changes in precipitation to anthropogenic warming.

4.2 Heatwaves

In contrast to NCA5, NCA4 examined heat extremes across the entire 20th century, pointing out that peak heat wave activity was reached in the 1930s and has decreased since then, and that recent increases are confined to areas west of the Rockies. NCA4 stated:

[The] warmest daily temperature of the year increased in some parts of the West over the past century, but there were decreases in almost all locations east of the Rocky Mountains. In fact, all eastern regions experienced a net decrease, most notably the Midwest (about 2.2°F [1.2°C]) and the Southeast (roughly 1.5°F [0.8°C]).

Since the mid-1960s, there has been only a very slight increase in the warmest daily temperature of the year (amidst large interannual variability). Heat waves (6-day periods with a maximum temperature above the 90th percentile for 1961–1990) increased in frequency until the mid-1930s, became considerably less common through the mid-1960s, and increased in frequency again thereafter. As with warm daily temperatures, heat wave magnitude reached a maximum in the 1930s. (NCA4 pp. 190-191)

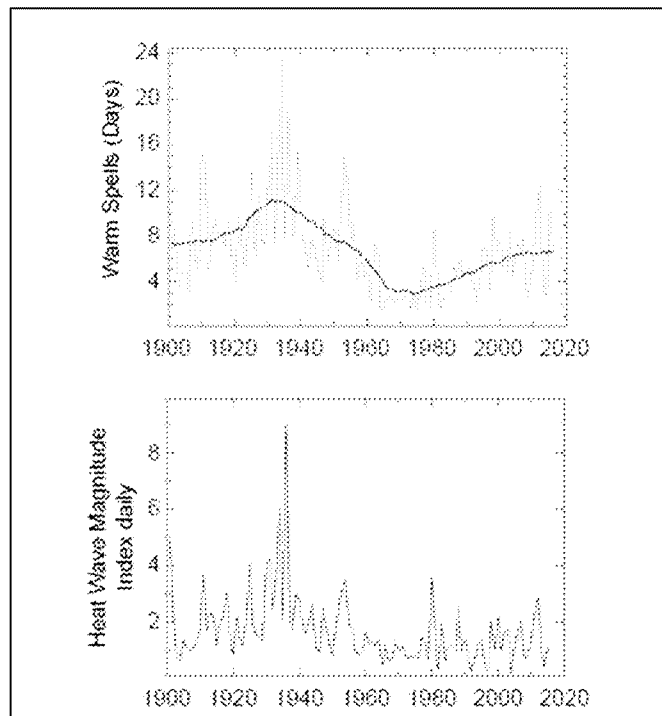


FIGURE 3. U.S. Heat waves since 1900. Reproduction of NCA4 Figure 6.4

Contrast this careful and factual language from NCA4 with NCA5 Key Message 2.2: “Extreme Events Are Becoming More Frequent and Severe.” This blanket statement is followed by NCA5 Figure 2.7 (reproduced as Figure 4 below) which shows the number of hot days, cold days and warm nights (respectively in panels a—c) over the period 2002-2021 compared to 1901-1960. [Presumably these are annual counts, although not stated in the caption.]

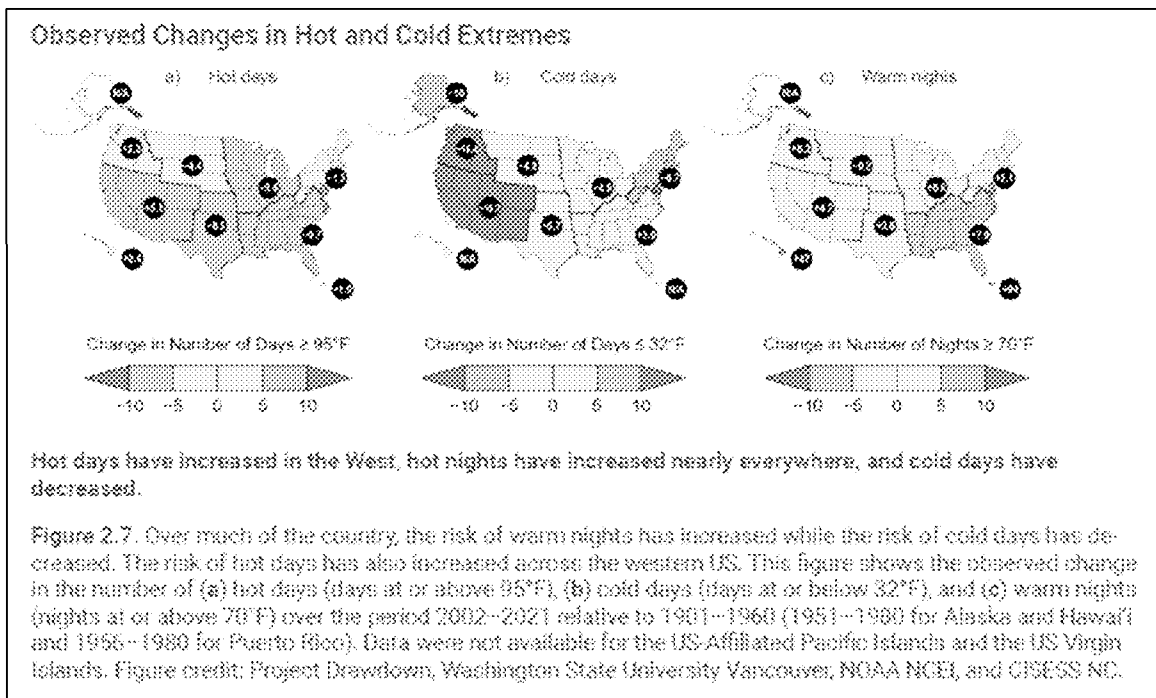


FIGURE 4: Reproduction of NCA5 Figure 2.7.

Close inspection shows that this figure actually contradicts the NCA5 Key Message with respect to heatwaves and instead reinforces the position of NCA4. Notwithstanding Key Message 2.2, the leftmost panel in NCA5 Figure 2.7 above shows that over most of CONUS the number of extreme heat days has *decreased* in recent decades compared to the prior century.

The accompanying discussion in NCA5 becomes convoluted as it appears to be aimed at supporting the Key Message despite the contrary evidence. NCA5 Chapter 2 elaborates on Key Message 2.2 by stating (page 16):

Observations show an increase in the severity, extent, and/or frequency of multiple types of extreme events. Heatwaves have become more common and severe in the West since the 1980s (*high confidence*).

But while it mentions the increase in hot days in the West, it fails to mention the decrease everywhere east of the Rockies. On the next page (page 17) it raises the comparison to the 1930s and then switches to discussing global counts:

By some measures, the most extreme heatwaves on record in the United States occurred during the Dust Bowl era of the 1930s. ... Globally such heatwaves are becoming more frequent, and in recent decades the western United States has been following those trends.

The reference to a global trend seems to be an attempt to tie heatwaves to anthropogenic climate change. But the obvious question, unaddressed by NCA5, is why one region follows the global pattern of increasing heatwaves while most of the country is trending in the opposite direction. These issues are addressed in Chapter 6 of CWG25, demonstrating that the range and magnitude of extreme temperatures are driven more by natural variability than by the small anthropogenic forcing. The analysis in CWG25 shows that for both (a) hot days ($\geq 95^{\circ}\text{F}$) and (b) number of days in heatwaves, the current decade is no hotter than a century ago in the U.S. Thus, the NCA5 claim that “multiday

heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades,” is simply false when expanding the temporal and spatial domains to encompass all available data (Chapter 6 and Figure 6.3.6 of CWG25).

NCA5 then pointed to the dramatic Pacific Northwest heatwave of 2021. CWG2025 Section 8.6.1 discussed this event in detail, reviewing the multiple peer reviewed studies that explained the unusual meteorological context was unrelated to human-caused climate change, a point omitted from the NCA5 discussion.

NCA5 finally addresses the declining heatwave trend in CONUS east of the Rockies but attempts to reframe it by focusing on urban warm spells.

[The] number of very hot days has actually decreased across the central and eastern regions due to summer cooling trends in the region (Figure 2.7; Ch. 22). This does not, however, mean the central and eastern US are not affected by heat. The impacts of extreme high temperatures are more severe if such conditions persist for several days, and overall, multiday heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades. Across 50 large US cities, the US Global Change Research Program heatwave indicator (<https://www.globalchange.gov/indicators/heat-waves>) shows that the average number of heatwaves has doubled since the 1980s, and the length of the heatwave season has increased from about 40 days to about 70 days.

We discussed this part of NCA5 in CWG25 Section 6.3. The figure referenced by NCA5 uses a short time period which begins in the 1960s, the coldest decade in the last 100 years, thus suppressing any comparison to the 1930s. Further, nighttime temperatures in urban areas have increased faster than daytime temperatures (which NCA5 acknowledges), but this is a signature of urban heat islands and not a good metric of climate change. CWG25 found that the occurrence of hot days ($\geq 95^{\circ}$ F) has recently increased in the West, but declined in the remainder of the country, and in the nationwide average, since 1899.

5 INADEQUATE TRACEABLE ACCOUNTS

NCA3 began the practice of including a section on Traceable Accounts at the end of each chapter. This is the description from NCA5:

Each chapter concludes with a section entitled Traceable Accounts, which provides information on the overall process used to develop the chapter as well as a separate Traceable Account section for each Key Message. These Traceable Accounts describe the supporting evidence behind each Key Message, the process and rationale authors used in reaching their conclusions, and the author team’s expert assessment of the confidence in and, where applicable, likelihood of these conclusions. As such, Traceable Accounts provide information about the state of the science, document sources of uncertainty, identify research gaps, and allow traceability to data and resources.

The Traceable Accounts for each Key Message includes the following sections:

- Description of Evidence Base
- Major Uncertainties and Research Gaps

- Description of Confidence and Likelihood

The Traceable Accounts could have addressed the statutory requirement that the NCA discuss scientific uncertainties. They could also help satisfy the Executive Order for Restoring Gold Standard Science by addressing reproducibility, transparency, communication of error and uncertainty, and skepticism of findings and assumptions. However, the Traceable Accounts in NCA5's Chapters 2 and 3 are uneven, often superficial and uninformative.

An example of a deficient Traceable Account is NCA5's Key Message 2.2: "Extreme Events are Becoming More Frequent and Severe". The "Description of the Evidence Base" offers two paragraphs, the first summarizing the findings and the second generically describing the types of data that can be used for storms. "Major Uncertainties and Research Gaps" focuses on the uneven distribution across U.S. populations due to differences in exposure and vulnerability. The only limitations in data referred to are the lack of a long-term record of lightning and the lack of homogenized daily and hourly temperature data apart from reanalysis products.

But the most astonishing deficiency is in the "Description of Confidence and Likelihood." One of the statements in Key Message 2.2 is:

Hurricanes have been intensifying more rapidly since the 1980s (*high confidence*) and causing heavier rainfall and higher storm surges (*high confidence*).

The Description of Confidence and Likelihood includes the following statement:

Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why the authors also have high confidence that storms are delivering more rainfall and high confidence that storm surges are becoming higher.

No reference to journal publications or a specific data set is made anywhere in the chapter regarding hurricane-induced precipitation or storm surge to support this *high confidence* conclusion.

The Traceable Accounts for the various Key Findings of Chapter 3 have some substantial inconsistencies. Consider

Key Message 3-1: Human activities have caused global warming.

Confidence and Likelihood: "There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have *unequivocally* caused all global warming observed over the industrial era. There is also *very high confidence* that changes in natural climate drivers have had globally small and regionally variable long-term effects over this period."

The Uncertainties section addresses only uncertainties in radiative forcing by greenhouse gases, ignoring the great uncertainty in model response (CWG25 Chapters 4&5) In contrast, the Traceability Analysis of Key Message 3-4 ("Humans Are Changing Earth System Processes") raises the problem that relatively little is known about the role of natural variability at the regional scale. From its Description of Evidence Base:

In the last decade, there has been increasing recognition of the role of regional-scale natural variability in the past and future evolution of climate, as well as the fact that regional natural variability signals can be competitive with forced anthropogenic signals.

And from its Major Uncertainties and Research Gaps:

For example, the true natural variability of the climate system on decadal to centennial timescales could be larger than what we estimate from GCMs, which would further increase the irreducible uncertainty stemming from natural variability.

These statements are among the most scientifically credible in the entire NCA5 and they directly undercut the confidence assigned to Key Message 3-1.

There is also a generic problem in tracing NCA5's Traceable Accounts. The Front Matter of NCA5 states:

Each figure and some tables are accompanied by a metadata survey, which can be accessed in the online version of the report by clicking on the eyeball icon above the figure or table (see the table below for explanations of additional icons used throughout the report). The metadata survey describes data sources, figure or table development methods, copyright information, and other important documentation.

Clicking on the 'eyeball' icon does not reveal the metadata information; instead a "Contact Us" email appears, addressed to the USGCRP. This is an inadequate way to archive the metadata information.

In summary, the Traceable Analyses examined here, with few exceptions, fail to meet the stated objectives of the NCA.

6 OVEREMPHASIS ON EXTREME SCENARIOS

To respond to the GCRA mandate to "project major trends for the subsequent 25 to 100 years," NCA5 relies on projections of future climate change based on estimates of future emissions (the so-called SSP scenarios) and/or specified levels of radiative forcing (the RCP scenarios). For the most part, NCA5 uses scenarios developed for the IPCC Assessment Reports.

CWG25 Section 3.2.1 presented a critical assessment of past and current IPCC scenario envelopes, showing that they have tended to overshoot observed emissions. IPCC AR6 published in 2021 stated that "The likelihood of high-emission scenarios like RCP8.5 and SSP5-8.5 is considered low in light of recent energy sector developments." and that same year UN Climate Negotiators (COP) stopped using scenarios above 4.5.

NCA5 makes the following observations about the scenarios they use:

NCA5 authors were advised to assess the full range of scenarios available. (Front Matter)

Scenarios of future emissions and land-use change are developed as plausible alternatives, but no relative likelihood is attached to them. Some recent studies, however, have argued that

the highest scenario, SSP5-8.5, is no longer plausible without a reversal of current trends in the adoption of renewables and energy efficiency. (Key Message 3.3 Traceable Analysis)

Despite acknowledging the issue, NCA5 otherwise ignored the problem. A keyword search of NCA5 of mentions of RCP/SSP scenarios finds over 50% referred to the extreme emissions scenarios RCP8.5/SSP5-8.5. Further, nine NCA5 figures (5.2, 6.9, 7.4, 11.3, 14.6, 22.13, 22.19, 27.9, 29.13) included *only* the 8.5 scenarios.

The problem of relying on extreme scenarios is particularly acute for NCA5's sea level rise projections. The sea level rise scenarios used in NCA5 do not relate directly to the SSP emissions scenarios, but rather to specified amounts of sea level rise by 2100. Table 4 of NCA5's "Guide to Using this Report" reproduced below shows that Low relates to 0.3 m (0.98 feet), Intermediate-Low relates to 0.5 m (1.64 feet), Intermediate relates to 1.0 m (3.28 feet), Intermediate-High relates to 1.5 m (4.92 feet), and High relates to 2.0 m (6.56 feet).

Table 4. Descriptive Terms for Common Sea Level Rise Scenarios Used in NCA5						
Future global mean sea level rise and sea level rise along United States coastline are shown for five scenarios in feet (and meters), relative to a 2000 baseline. The US values shown in the right half of the table are averaged across the US coastal regions, including the contiguous US, Alaska, Hawaii, and the US-Affiliated Pacific Islands, and the US Caribbean. The national values shown in the table differ substantially from regional values. For example, sea level rise is higher in the Gulf Coast and lower or even negative in some parts of Alaska. In the next 30 years (2020–2050), sea level along the contiguous US coasts is expected to rise 0.92 feet (0.28 m), the same amount of sea level rise observed over the last 100 years (1920–2020). See Chapter 9 for regional sea level information. Adapted from Sweet et al. 2022.”						
Sea Level Rise Scenario Descriptor	Global Mean Sea Level			United States		
Year	2050	2100	2150	2050	2100	2150
Low	0.49 (0.15)	0.98 (0.3)	1.31 (0.4)	0.59 (0.18)	0.98 (0.3)	1.64 (0.5)
Intermediate-Low	0.66 (0.20)	1.64 (0.5)	2.62 (0.8)	0.75 (0.23)	1.64 (0.5)	2.95 (0.9)
Intermediate	0.92 (0.28)	3.28 (1.0)	6.23 (1.9)	0.89 (0.27)	3.28 (1.0)	6.89 (2.1)
Intermediate-High	1.21 (0.37)	4.92 (1.5)	8.86 (2.7)	1.12 (0.34)	4.92 (1.5)	8.86 (2.7)
High	1.41 (0.43)	6.56 (2.0)	12.14 (3.7)	1.38 (0.42)	6.56 (2.0)	12.46 (3.8)

TABLE 1: Reproduction of Table 4 from the Front Matter of NCA5

Considering only projections representing processes quantified with at least medium confidence, IPCC AR6 assessed global mean sea level projections for all emissions scenarios (including implausible extreme emissions scenarios) for 2100 to fall between 0.2 and 1.6 m (5th—95th percentile range). Nevertheless, the range of sea level rise scenarios considered by NCA5 extends to 2.0 m. Further, NCA5 fails to include plausible lower scenarios, such as 0.2 m cited by the IPCC, which also corresponds to the average rate of sea level rise over the past century.

Chapter 9 of NCA5 offers the following predictions of sea level rise:

“Under a range of potential global warming levels, average sea level along US coastlines is *likely* to be between 12 and 20 inches above 2000 sea levels in 2050 (Figure 9.2).”

The projected sea level rise values span from the Intermediate scenario to values slightly greater than the High scenario. They can be put into context by considering the observed global sea level rise from 2000-2024, which is only approximately 3.4 inches (0.28 feet). NCA5 is thus projecting a sea level rise during 2025 and 2050 that is 3.5 to 5.8 times the rate observed during 2000-2024, an exceedingly implausible outcome. Chapter 9 further states:

“Looking toward the future, an 11 inch (28 cm) average rise along the contiguous US coastline is expected by 2050 (relative to 2020), with a *likely* range of 9-13 inches.”

...

“There is *high confidence* and it is *likely* that sea levels will rise about 11 inches (likely range of about 9–13 inches) between 2020 and 2050”

In summary, NCA5 presents future sea level rise scenarios that are not directly relatable to either SSP/RCP emissions scenarios or to plausible global warming levels. The NCA5 scenarios include two that are higher than the 95th percentile for the extreme emissions scenario RCP8.5 and include hypothesized ice sheet processes in which there is low confidence. Projections to 2050 require rates of sea level rise from 2025 to 2050 that are more than triple the rate observed during 2000-2024. Further, NCA5 ascribes *high confidence* to these sea level rise projections. CWG25 Section 7.3 provides further context for USGCRP projections of extraordinary sea level rise in the next 25 years.

More generally, NCA5’s inclusion of, and even focus on, implausible extreme scenarios supports projections of alarming impacts that are very unlikely to be driven by anthropogenic warming.

7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES

NCA5’s Glossary defines “climate change” as a change in climate for any reason. This is technically correct, but at variance with the (now) popular perception of all climate changes being anthropogenic. The distinction is not academic- it is central both to attribution questions and to projections, since anthropogenic changes would respond to mitigation, while natural changes are unavoidable.

The discussion on NCA5 page 2-4 begins “Human activities are changing the climate”, then goes on to list evidence for anthropogenic GHG emissions and climate warming. The next paragraph begins “Climate change is happening now in the United States. Including Alaska, the continental US has been warming about 60% faster than the planet as a whole since 1970.” The implication is that the warming of CONUS faster than the planetary average is an effect of GHG emissions. But it is an artifact of the Earth’s surface being 70 percent ocean. Since the ocean warms more slowly than land, comparison of any land surface outside the tropics with the global average would show the land surface to be warming faster than the global average, regardless of the cause of the warming.

The same page goes on to say “Climate change is already affecting people in the United States. Extreme heat was estimated to be responsible for more than 700 deaths per year between 2004 and 2018 although some estimates put heat-related mortality closer to 1,300 deaths annually.” But extreme heat, whether natural or not, has always been a risk to human health. As to trends, the data show that adaptation has caused the mortality burden of extreme heat to drop substantially in recent decades (CWG25 Section 10.3.1).

Consider also the NCA5 statement on precipitation that we cited in Section 3.2:

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

The attribution is superfluous because the statement is a tautology by NCA5's definition of climate change. But its gratuitous inclusion effectively attributes the observed trend to greenhouse gas emissions.

Exploitation of the ambiguity in "climate change" is endemic to NCA5. The NASEM review (pp. 23-24) commented on this problem as follows:

The draft NCA5 report frequently describes "change" but does not consistently distinguish between natural variability and climate change. This lack of clarity can be misleading for the reader by creating the misconception that some impacts that are the result of the combination of natural variability and climate change are instead solely due to climate change... it is important for NCA5 authors to accurately identify the multiple drivers of change (including global change), in addition to climate change, and accurately attribute impacts. Clearly describing impacts due to natural variability, climate change, or a combination of the two is important not only for informing policy decisions, but also for building public understand and trust in the report's messages. Climate change and natural variability should be clearly defined in the glossary and natural variability could be introduced in chapter introductions when the concept is important for understanding key messages.

This could have been easily addressed by reserving the term "climate change" for anthropogenic changes and using "climate variability" for natural changes. But the NCA5 authors seemingly ignored their recommendation.

A separate but related issue is use of the term "climate change" to refer to increases in socioeconomic vulnerabilities that have anthropogenic but non-GHG-related causes. NCA5 page 1-19 states "Climate change exacerbates inequalities." But the issue discussed is the negative correlation between neighborhood-level income and land surface temperatures (LST) in urban areas. To the extent the correlation is real, the most likely explanation is that low-income households concentrate where housing is less expensive, which may be in neighborhoods with less nearby parkland and tree cover, which has nothing to do with CO₂ emissions.

8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6

This chapter summarizes our evaluation of NCA5 relative to OSTP's charge: whether NCA5 (1) complied with the USGCRP's statutory obligation; (2) adheres to the core tenets of Gold Standard Science; and (3) can suitably inform federal climate and energy policy. The points made in this summary analysis refer to specific sections of this report as well as to the CWG25 report.

8.1 Compliance with USGCRP's statutory obligation

As cited in Section 1.2 of this report, the Global Change Research Act requires an assessment that:

- (1) integrates, evaluates, and interprets the findings of the [Global Change Research] Program and discusses the scientific uncertainties associated with such findings;

- (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

We deem NCA5 to have fallen short when evaluated against these criteria because of the following major shortcomings (each is detailed in the chapters cited):

- Inadequate assessment of the relevant topics in climate science and the hazard components of climate impacts (such as hurricanes and floods). NCA5 instead focuses on evaluation of societal vulnerabilities (such as flood infrastructure, access to air conditioning, etc.), “Climate Action,” and policy recommendations with a social justice emphasis (Section 1.2).
- Overconfidence in conclusions and inadequate assessment of uncertainties (Section 3.1.5)
- Inadequate discrimination between natural and human-induced causes of trends and impacts (Chapter 7)
- Inadequate analysis of climate trends by relying on short time periods (Chapter 6)
- Uncritical evaluation of emission scenarios and climate model simulations in making projections for the next 25 to 100 years (Chapter 6; Section 3.2.1 and Chapter 5 of CWG25).

8.2 Adherence to the tenets of Gold Standard Science

With respect to the tenets of Gold Standard science listed in Section 1.2 of this report, we have identified the following major shortcomings in NCA5:

- **Lack of reproducibility.** In the few examples that we examined closely, we identified an instance where we could not reproduce the findings of the NCA5, a task that should require only rudimentary data analysis (Section 4.1)
- **Lack of transparency.** In many instances, the Traceable Account fails to justify the Key Finding. Metadata was not readily accessible. (Chapter 5)
- **Inadequate communication of error and uncertainty.** The Traceable Account for each Key Message provides a section on Major Uncertainties and Research Gaps; most of the accounts that we examined were superficial and uninformative. (Chapter 5)
- **Not skeptical of findings and assumptions.** The main text of the chapters is, with few exceptions, not skeptical of its findings and assumptions and does not mention dissent or disagreement. (Chapters 3, 5)
- **Some hypotheses and Key Messages are not falsifiable.** Key Message 13.4 is but one of many examples: “Equitable Distribution of Transportation Trade-offs and Benefits Requires Community Involvement.”
- **Failure to acknowledge benefits** of warming and additional atmospheric CO₂ (CWG25 Section 2.1, Chapter 9)
- **Inadequacy of the peer review process.** The review of the NCA5 Third Order Draft by National Academies of Science, Engineering and Medicine (NASEM) identified some of the deficiencies we have noted, but the NCA5 authors were not obligated to adopt the NASEM recommendations. More importantly, we’ve identified many other deficiencies in NCA5; the NASEM review did not point them out and thus lacked the rigor expected of NASEM reports.

8.3 Suitability for informing Federal climate and energy policy

We assess that the selection and presentation of information in NCA5 makes it an unreliable basis for U.S. climate and energy policy making. For each of the elements of knowledge characterization suitable for risk management listed in Section 1.3, here are specific examples where NCA5 falls short:

- The degree to which the assumptions made are reasonable/realistic based on background knowledge
 - NCA5 focused on implausibly extreme scenarios for emissions and sea level rise scenarios and made policy recommendations without adequate consideration of the costs
- The degree to which data/information exists and are reliable and relevant
 - NCA5's unjustified assumptions about model reliability, and its use of short time periods for analysis, does not support its high-confidence conclusions
- The degree to which there is disagreement among experts, including those from different environments or academic fields
 - While NCA5 was an interdisciplinary effort, the concerns we have raised all point to a failure to canvass or communicate the full range of evidence including data and research findings that speak against Key Messages.
- The degree to which the phenomena involved are understood and accurate models exist
 - NCA5 is not appropriately skeptical of the ability of climate models to attribute the causes of warming and extreme events or to project future climates
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns
 - A major NCA5 shortcoming is its dismissal of natural climate variability in many contexts where it should have been a major consideration

NCA5 is also problematic for informing policy because its hyperbolic language promotes alarm and advocates for specific policies without a proper risk analysis. The NASEM Review of the NCA5 underscores the endemic nature of this problem - their review appears to be written by authors who share many of the biases of the NCA5 team, with an inordinate focus on social and policy issues. It is then not surprising that objectivity can suffer when climate scientists communicate their understanding to non-experts. Further, the field of climate science has been politicized by NetZero mandates. This lack of objectivity usurps the public's right to make informed choices and undermines their confidence in the scientific enterprise.

Philip Handler, President of the National Academy of Sciences, identified the problem forty-five years ago in an editorial that still resonates:

Difficulty arises in the scientific community from confusion of the role of scientist *qua* scientist with that of scientist as citizen, confusion of the ethical code of the scientist with the obligation of the citizen, blurring the distinction between intrinsically scientific and intrinsically political questions. When scientists fail to recognize these boundaries, their own ideological beliefs, usually unspoken, easily becloud seemingly scientific debate.

8.4 Recommendations for NCA6

While we have assessed NCA5 to be scientifically inadequate and unsuitable as a basis for decision-making, one can imagine a different National Climate Assessment that meets statutory and policy maker requirements. The goal should be not to persuade, but to impart understanding by being objective, transparent and complete. A suitable NCA would be an important complement to IPCC assessments to the extent that its analysis and conclusions differ from the "consensus" of the IPCC

reports and additional topics are addressed. Such a report would promote a more open scientific discussion and a more informed policy debate.

We recommend that the NCA6 have a narrower scope than NCA5, refocusing on climate science, including natural climate variability, with topics to include:

- How the climate has changed in the past. The U.S. has the best and longest meteorological records and they should be examined and displayed in their entirety. Trend analyses should include longest periods available and employ suitable statistical methods. Local paleoclimate data should be considered where available. Analysis should demonstrate not only how the climate has varied and changed, but also regional heterogeneity. Standard, easily understandable metrics should be employed.
- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future. The regional chapter for REGION that includes Texas only stated that
- A critical survey of current global and regional modeling capabilities and their suitability for regional impact assessments and projections. This would include an assessment of their ability to reproduce observed changes. It should also discuss alternative methods for generating projections and forecasts on regional and decadal scales, along the lines of Chapter 10 of the IPCC AR6 WGI Report.
- Assessment of the impacts of recent historical climate variability and change on ecosystems and society. Where long-term data indicate a detectable regional change, regional projections can be made for the period 2030-2050. Emissions scenarios exceeding RCP4.5/SSP2-4.5 and ECS values exceeding 4°C should not be used. Regional projections to 2100 have no credibility at this time.

It is important that climate projections be assessed in context of current science capabilities. The pressures toward spatially or temporally precise projections should be resisted as the current models are nowhere up to the task (an example is discussed in CWG25 Section 5.8). In that light, the many pages of NCA5 devoted to projected regional and sectoral impacts have little value.

Given the substantial deficiencies and bias in NCA5 that we have identified, producing an objective NCA6 report with the current NCA organizational construct would be a challenge. A NASEM review could help, but only if the selected participants reflect full viewpoint diversity and do not simply mirror the assumptions and biases of past NCA teams. We regard the CWG25 report to be a good start on NCA6 in terms of scope and objectivity, including adherence to the tenets of Gold Standard Science.

More broadly, we recommend a rewrite of the Global Change Research Act. The current mandate is vague and off point, allowing successive NCA teams to interpret the mandate as they see fit. Moreover, it is becoming increasingly clear that current and foreseeable models are not fit-for-purpose to describe regional climates, let alone usefully project them for 25 and 100 years. Further, the use of the term “global change” is ambiguous and outdated.

9 REFERENCES

Aven, Terje (2017) “Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices,” *Reliability Engineering & System Safety*

- 167 (November 2017): 42–48
<https://www.sciencedirect.com/science/article/pii/S0951832016306950>
- Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.
- Diffenbaugh, N.S., D. Singh, and J.S. Mankin, 2018: Unprecedented climate events: Historical changes, aspirational targets, and national commitments. *Science Advances*, 4 (2), 3354. <https://doi.org/10.1126/sciadv.aao3354>
- Kirchmeier-Young, M.C. and X. Zhang, 2020: Human influence has intensified extreme precipitation in North America. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (24), 13308–13313. <https://doi.org/10.1073/pnas.1921628117>
- Knutson, Thomas and Fanrong Zeng (2018) “Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends” *Journal of Climate* 31(12) <https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml>
- National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26757>.
- NCA4. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I* (D. J. Wuebbles, D. W. Fahey, and K. A. Hibbard, Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/J0J964J6>
- NCA5. (2023). *Fifth National Climate Assessment* (A. R. Crimmins et al., Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023.CH1>
- Schlund, Manuel, Axel Lauer, Pierre Gentine, Steven C. Sherwood, and Veronika Eyring (2020) Emergent constraints on equilibrium climate sensitivity in CMIP5: do they hold for CMIP6? *Earth System Dynamics* 11 1233–1258 <https://doi.org/10.5194/esd-11-1233-2020>

APPENDICES

APPENDIX 1: Charge to the review

ABOUT THE AUTHORS

[Insert updated bios]

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Sunday, July 13, 2025 1:55 PM
To: Steven Koonin
Cc: John Christy; judith curry; Roy W. Spencer; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress
Attachments: NCA5.ReviewJuly10.docx; SI.Precipt_trends_reproducing.docx

Steve- this is the most recent version I have. There is also a Supplement on precip trends.

On Sat, Jul 12, 2025 at 6:18 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes,

we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

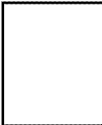
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

Critique of the Fifth National Climate Assessment

EXECUTIVE SUMMARY	3
1 INTRODUCTION	4
1.1 ABOUT THIS REPORT	4
1.2 ABOUT THE NATIONAL CLIMATE ASSESSMENTS	4
1.3 STANDARDS FOR ASSESSING NCA PRODUCTS	5
1.4 WHEN PEER REVIEW FAILED	6
2 NCA5 OVERVIEW CHAPTER: HYPERBOLIC ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE.....	9
3 OVERCONFIDENCE WHEN STATING CONCLUSIONS	11
3.1 INFLATED CERTAINTY LEVELS	11
3.2 OVERSTATING FINDINGS IN UNDERLYING SOURCES	12
3.3 TECHNICAL EXAMPLE: EMERGENT CONSTRAINTS	13
4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS.....	15
4.1 AVERAGE AND EXTREME PRECIPITATION.....	15
4.2 HEATWAVES.....	16
5 INADEQUATE TRACEABLE ACCOUNTS.....	19
6 OVEREMPHASIS ON EXTREME SCENARIOS	21
7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES	23
8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6.....	24
8.1 COMPLIANCE WITH USGCRP'S STATUTORY OBLIGATION	24
8.2 ADHERENCE TO THE TENETS OF GOLD STANDARD SCIENCE	25
8.3 SUITABILITY FOR INFORMING FEDERAL CLIMATE AND ENERGY POLICY	26
8.4 RECOMMENDATIONS FOR NCA6.....	26
9 REFERENCES	28
APPENDICES.....	30
APPENDIX 1: CHARGE TO THE REVIEW	30
ABOUT THE AUTHORS.....	31

EXECUTIVE SUMMARY

This report critically evaluates the Fifth National Climate Assessment (NCA5), finding it an inadequate basis for climate and energy policies. A detailed review of the foundational chapters on climate science raises several key concerns:

Scientific Integrity

- An advocacy tone, particularly in the Overview chapter, that is inconsistent with scientific objectivity
- Endemic overconfidence when stating conclusions, including inflated certainty levels and overstatement of findings from underlying sources

Flawed methodology

- Use of short time periods for trend analyses; more generally lack of a consistent rule for choosing time scales
- Overemphasis on extreme scenarios for future emissions and sea level rise
- Inadequate traceable accounts to support key conclusions

Deficient Review Process

- A review by the National Academy of Sciences, Engineering, and Medicine (NASEM) failed to challenge some fundamental flaws in NCA5
- The NCA5 authors failed to adopt some improvements recommended by NASEM

The report shows NCA5 to be a biased and incomplete picture of climate science that skews toward excessive climate risk. Consequently, NCA5 should not be used as basis for climate and energy policies.

1 INTRODUCTION

1.1 About this Report

This report responds to a request from the Office of Science and Technology Policy (OSTP) Director Michael Kratsios (reproduced in Appendix 1) that we assess the suitability of the Fifth National Climate Assessment (NCA5 2023) for informing climate and energy policies.

To conduct this assessment, we reviewed NCA5 itself, the National Academies of Science, Engineering and Medicine (NASEM) review of the Third Order NCA5 Draft, and the USGCRP responses to that review. We have drawn upon our long experience working on advisory reports, including for the NASEM, the Intergovernmental Panel on Climate Change (IPCC) and other organizations, as writers, reviewers and study leaders.

We find that NCA5 should not be relied on for policy making as it is an incomplete and misleading picture of our understanding of the changing climate and the risks it poses to the nation. NCA5 was selective and incomplete in its survey of climate science. Further, we have reviewed recent scientific developments in a separate report to Energy Secretary Wright (Climate Working Group 2025, herein denoted “CWG25”). The overall effect of the biases and omissions of NCA5 is an excessively dire picture of climate risk.

To support our finding, the following sections of this chapter provide some background on the National Climate Assessments and the standards by which we have assessed NCA5. Chapters 2 through 7 detail important ways in which NCA5 fails to meet those standards. Finally, Chapter 8 summarizes our evaluation of NCA5 and makes recommendations for NCA6.

1.2 About the National Climate Assessments

The U.S. Global Change Research Program (USGCRP) was established by Presidential Initiative in 1989 and mandated by Congress in the Global Change Research Act (GCRA) of 1990 to develop and coordinate “a comprehensive and integrated United States research program which will assist the Nation and the world to understand, assess, predict, and respond to human-induced and natural processes of global change.”

The National Climate Assessment (NCA) Reports evolved from the GCRA requirement to:

Prepare and submit to the President and the Congress an assessment which (1) integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings; (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

The five NCA Reports to date have interpreted this mandate in different ways:

- NCA1 (2000) was a multidisciplinary effort to study and portray in regional detail the potential effects of human-induced global warming on the United States.

- NCA2 (2009) was a relatively short report that not only focused on the potential consequences of climate change but also sought to identify potential adaptation measures and identify the highest priorities for future research.
- NCA3 (2014) was an expanded effort that continued along the lines of NCA2, and was distinguished by a comprehensive review process, including a review by the National Academy of Sciences. NCA3 introduced a traceability analysis for each key finding, including a description of uncertainties.
- NCA4 (2017/2018) was a further expanded effort that was published in two volumes: I Climate Science Special Report (CSSR), and II Impacts, Risk, and Adaptation in the United States. This was the first NCA report to devote significant effort to assessing climate science.
- NCA5 (2023) returned to a single volume format, reducing discussion of climate science to a cursory two chapters, with continuing focus on regional and sectoral impacts of climate change. NCA5 expanded its remit to topics that are arguably outside the purview of the USGCRP, focusing on “Climate Action” and policy recommendations with a social justice emphasis.

These successive interpretations of the NCA are poorly aligned with the GCRA’s statutory requirements. Only NCA4 gives serious consideration to climate science, which receives the great majority of USGCRP funding, and even then NCA4 misrepresents some important points. Natural climate variability is essentially dismissed as unimportant in NCA4 and barely mentioned in NCA5 in most contexts, despite the mandate to include both human-caused and natural climate change. Most significantly, NCA5 has redirected the focus away from climate science and even the hazard elements of impacts, towards evaluation of societal vulnerabilities and advocacy for particular policy options, especially deployment of wind and solar generation. The cover image for the NCA5 Report is the installation of a solar panel.

1.3 Standards for Assessing NCA Products

Beyond the statutory requirements stated above, another pertinent standard is President Trump’s executive order of May 23, 2025, Restoring Gold Standard Science. It enumerates some of the characteristics of good science, namely that it should be:

- i. reproducible;
- ii. transparent;
- iii. communicative of error and uncertainty;
- iv. collaborative and interdisciplinary;
- v. skeptical of its findings and assumptions;
- vi. structured for falsifiability of hypotheses;
- vii. subject to unbiased peer review;
- viii. accepting of negative results as positive outcomes; and
- ix. without conflicts of interest.

Although these should be self-evident to those trained in science, it is surprising that some scientists have found them controversial (Dellawalla et al. 2025).

====debated text:

When science is assessed for the purpose of climate policymaking there are further requirements to bear in mind. Good climate and energy policies should balance the risks and benefits of a changing

climate against the world's growing demand for reliable and affordable energy. To strike that balance, policymakers must understand at least two complex and nuanced topics: the certainties and uncertainties of climate science and the technoeconomic realities of energy systems. Experts in those subjects have a responsibility to communicate their understanding to non-experts clearly, completely, and without bias.

Much expertise in energy systems resides in the private sector, where it is essential to providing the reliable and affordable energy services that are the lifeblood of society. Understanding is therefore continually refined and tested by operational demands and the discipline of the marketplace. In contrast, climate science expertise is found largely in the non-profit realm of universities and government laboratories and so has a more academic character, with greater uncertainties and hence need for expert judgement.

=====

For those reasons assessments of climate science that will be influential for policy making must include statements about the strength of knowledge. The IPCC's approach to assessing strength of knowledge is based on judgment of the available evidence and agreement among experts. But there are more sophisticated knowledge characterizations for risk management. Here are the elements according to Aven (2017):

- The degree to which the assumptions made are reasonable/realistic based on background knowledge
- The degree to which data/information exists and are reliable and relevant
- The degree to which there is disagreement among experts (including those from different environments or academic fields)
- The degree to which the phenomena involved are understood and accurate models exist
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns (issues that are known to matter but are ignored, such as, in this context, natural variability).

1.4 When Peer Review Failed

Peer review of reports like IPCC and NCA products is not a silver bullet that guarantees quality. The peer review process for these reports differs in some important respects from traditional peer review in academic journals. First, during the open review phases of early NCA drafts reviewers are volunteers who self-select what parts of the report to read, whereas the editors of academic journals editors recruit reviewers with relevant expertise and assign them to specific papers. As a result, there is no guarantee at that stage that any particular section of an NCA report was reviewed by anyone, let alone by someone with relevant expertise and a perspective that differs from the authors. In fact, many potential reviewers have given up over the years because their input has been systematically ignored. The introduction of a NASEM review stage is at best a partial remedy for this. However, NCA authors have near complete authority whether to accept or reject reviewer comments. By contrast, the Editor of an academic journal mandates the author to respond, and the reviewer and Editor assess its adequacy. Finally, the work of an NCA chapter author team is guaranteed to be published, whereas academic journals routinely reject papers that do not pass review.

These points are important to bear in mind because some readers might dismiss any criticism of NCA products out of hand on the grounds that they were "peer reviewed". But the test of a report is whether its contents are a valid representation of the available evidence. Here we give an example in

which NCA4 gave prominence to a figure that completely misrepresented the underlying data and which evaded peer review to do so. Further details can be found in Koonin (2024).

NCA4's Part I says (prominently and with *Very High Confidence*) on Page 19 of the Executive Summary:

There have been marked changes in temperature extremes across the contiguous United States. The number of high temperature records set in the past two decades far exceeds the number of low temperature records.

and offers this figure in support:

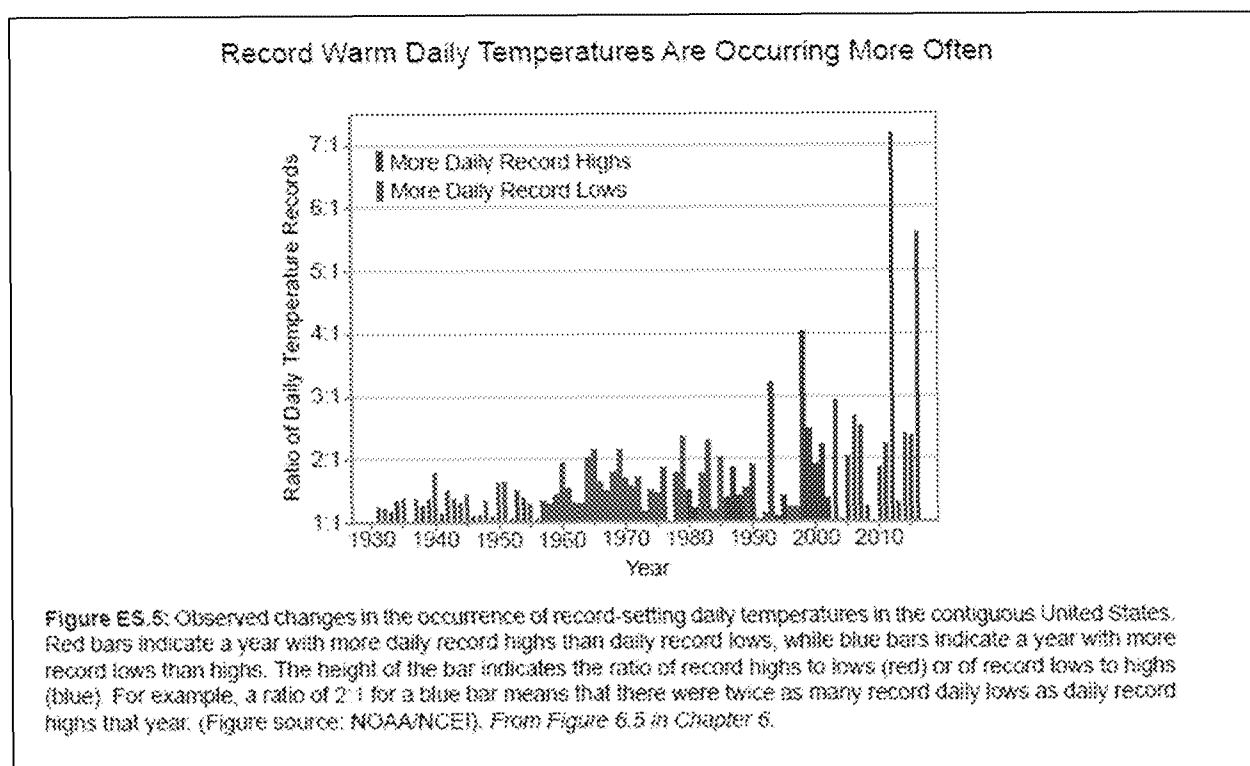


FIGURE 1: Reproduction of Figure ES.5 from NCA4

The figure appears to validate the claim that record warm daily temperatures are occurring more often. But the underlying data do not. Rather, they show that extreme heat in the U.S. peaked in the 1920s and 1930s and declined thereafter, as supported by Figure 6.4 deep within the CSSR itself (reproduced in Section 4.2 of this report).

Figure ES.5 does not even show what its title implies, as it displays not simple counts of cold and warm extreme events, but rather ratios of the two counts. As defined in the analysis, both types of extremes declined over the sample interval, but cold events declined more than warm events, so the ratio of warm extremes to cold extremes increased. By graphing the ratio instead of counts, NCA4 created a visual impression opposite to what is in the data.

Figure 6.3.3 of CWG25 (reproduced below) shows the results of a proper analysis and presentation of the data – defining each record as the singular extreme in the sample interval, displaying numbers

of warm and cold records separately, and beginning the analysis in 1899 rather than 1930. It makes evident the exceptional heat of the 1920s and especially the 1930s, peaking in 1936. (The increased heat of the past five years is too brief to be deemed climatically significant and, in any event, occurred after the CSSR was published in 2017.) The frequency of cold records has declined, especially over the last quarter of the period in which only 13 percent of the extreme cold events were measured. In contrast, 25 percent of the heat records were achieved in the last quarter, which is consistent with statistical expectations. As a result, the ratio of hot to cold extremes shown in Figure ES.5 of the CSSR explodes in recent decades. The overall reduction in numbers of both cold and hot extremes over the past century indicates a climate *less* prone to extremes, in sharp contrast to the message of NCA4 Figure ES.5.

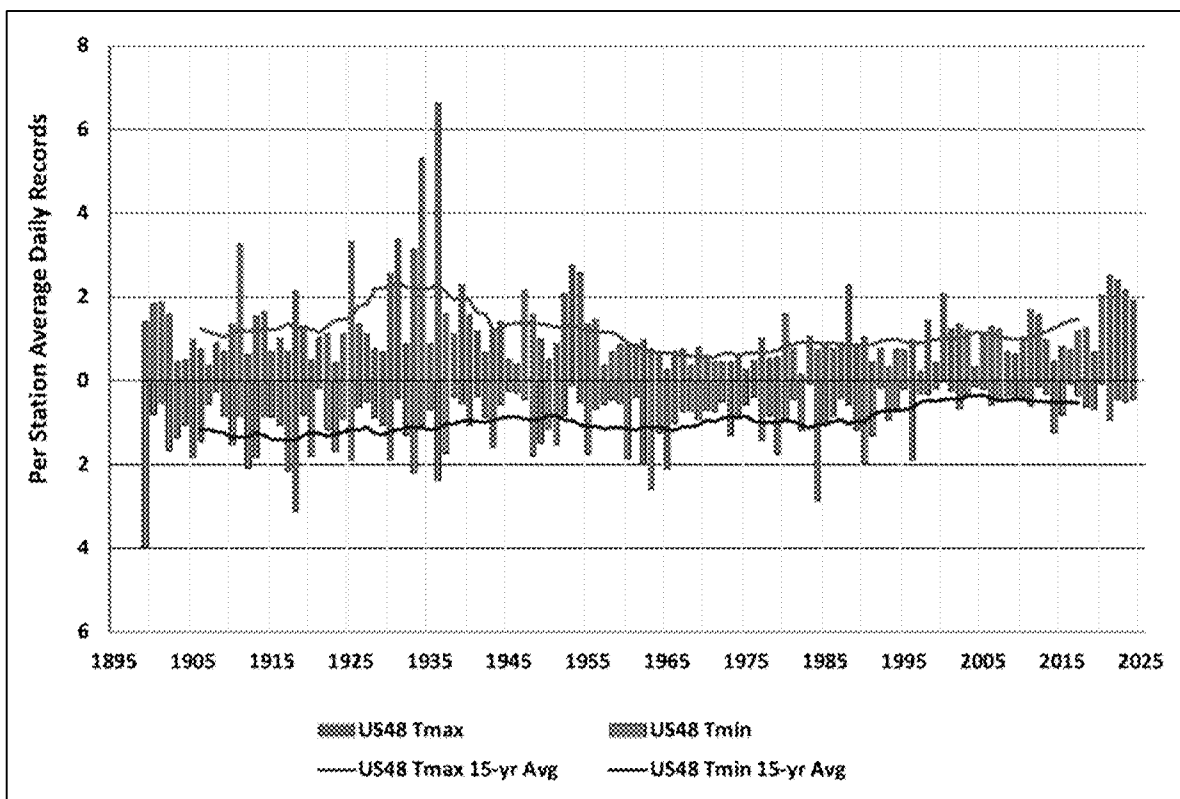


FIGURE 2: Number of daily record High (red) and Low (blue) temperatures for warm and cold seasons in the CONUS. The lines represent the 15-year running, centered average. Source: 1,211 USHCN stations supplemented as needed to achieve a minimum of 92 percent of observations in the 126-year period since Dec 1898. US48: contiguous U.S. states. Tmax: maximum temperature. Tmin: minimum temperature. Source: CWG25 Figure 6.3.3.

How did the flawed figure ES.5 pass the NCA4 NASEM Review? The NASEM Review panel criticized the discussion of temperature extremes in a late draft of the CSSR. Key Finding 2 of Chapter 6 in that draft stated:

Accompanying the rise is [sic] average temperatures, there have been – as is to be expected – increases in extreme temperature events in most parts of the United States. Since the early 1900s, the temperature of extremely cold days has increased throughout the contiguous

United States, and the temperature of extremely warm days has increased across much of the West. In recent decades, intense cold waves have become less common while intense heat waves have become more common. (*Extremely likely, Very high confidence*)

In reference to this NASEM said:

Further, it is difficult to understand how a statement that includes increases in extreme warmth can be associated with a high confidence or extremely likely statement, given that most of the graphics in this chapter show a decrease in extreme warmth in the historical record.

The Federal official in charge of the CSSR (Michael Kuperberg, Executive Director of the USGCRP) responded to the Academies' review by noting that

Almost every recommendation from the NAS was incorporated [in the final version]... and a new figure was added on changes in record high and low temperatures

The "new figure" referred to is the misleading Figure ES.5, which did not appear in the draft reviewed by the Academies' panel. It seems unlikely that the Academies panel ever saw that figure because they surely would have commented if they had and it wouldn't have survived to publication. And the figure's problems were evidently not flagged (or were ignored) in the subsequent internal government reviews.

With this background from NCA4, we now present our critique of NCA5.

2 NCA5 OVERVIEW CHAPTER: HYPERBOLIC ADVOCACY LANGUAGE AND UNSCIENTIFIC TONE

NCA5 Chapter 1, "Overview", holds a prominent place in the Report since it summarizes the entire report and is the only section that many will read. Although some material in the later chapters of NCA5 is not without merit, Chapter 1 is marred by an activist tone and language that aggressively promotes mitigation policies. As such, this chapter adds an imprimatur of scientific authority to naïve and simplistic declarations of opinion about public policy. Many examples can be cited; here we note a few that are particularly egregious.

Chapter 1 opens as follows:

The more the planet warms, the greater the impacts. Without rapid and deep reductions in global greenhouse gas emissions from human activities, the risks of accelerating sea level rise, intensifying extreme weather, and other harmful climate impacts will continue to grow. Each additional increment of warming is expected to lead to more damage and greater economic losses compared to previous increments of warming, while the risk of catastrophic or unforeseen consequences also increases.

This statement presupposes that all warming is anthropogenic, that all warming is bad and causes economic damage, and that warming intensifies extreme weather. Such sweeping generalizations go well beyond what science has or can establish. The statement also refers to growing risks without saying whether they were large to begin with – a small risk that grows may still be a small risk, and a large risk may be only incrementally worsened.

On the next page the Overview states:

Each additional increment of warming leads to greater risks [here it lists 7 key components of society including food security and the economy]... Without deeper cuts in global net emissions, climate risks to the US will continue to grow... Action to limit future warming and reduce risks can have near-term benefits and opportunities: low-carbon energy jobs, Improved air quality, Health benefits, Economic benefits...”

The authors write as if climate policy does not involve trade-offs and all measures to reduce future warming will be effective and beneficial. Neither the vast body of scholarship on climate science and economics, nor historical experience, support such simplistic claims (CWG25 ch.XX). Not every additional increment of warming leads to economic harms; in fact, NCA5 Chapter 19 acknowledges that there will also be benefits. Nor is climate policy guaranteed to benefit the economy; it could impose net costs. Such misleading statements are a disservice to policymakers.

Pages 8 and 9 of the Overview promote renewable energy options by noting, correctly, that the levelized costs of wind/solar generation have fallen sharply since 2010, and so offers this rationale for pursuing deep emission reductions:

Recent growth in the capacities of wind, solar, and battery storage technologies is supported by rapidly falling costs of zero- and low-carbon energy technologies, which can support even deeper emissions reductions. For example, wind and solar energy costs dropped 70% and 90%, respectively, over the last decade, while 80% of new generation capacity in 2020 came from renewable sources.

Yet it has long been known that intermittent renewables generation must be supplemented by dispatchable generation to meet grid reliability standards, and that doing so (e.g., through natural gas, fission, or storage) significantly increases the cost of electricity. Further, there are yet unmet synchronization challenges in electrical grids with heavy penetration of wind and solar generation. Here again it is advisory malpractice not to acknowledge these facts. But more importantly, we see no reason for NCA5 to be discussing renewable energy technologies and economics in the context of its mandate.

Page 14 of the Overview presents future emission scenarios with the following description: “Climate modeling experts develop global climate projections for a range of plausible futures.” The word “plausible” is applied to all the scenarios. The accompanying figure includes both SSP3-7.0 and SSP5-8.5, the latter reaching the same radiative forcing as RCP8.5. The figure does not compare observed emissions with previous projections, nor does it caution readers that SSP3-7.0 and SSP5-8.5 are extreme scenarios that, like RCP8.5, have been heavily criticized in the scientific literature as being implausible (CWG25 3.2.1). By describing the entire envelope of emission projections as “plausible” the report opens the door to later presenting impacts associated with implausible worst case emission scenarios as part of a baseline “business-as-usual” future.

Page 17 of the Overview introduces the discussion of risks from extreme weather events by saying “Harmful impacts from more frequent and severe extremes are increasing across the country.” This creates the impression that extreme weather events are worsening and that disaster losses are driven by trends in extreme weather. While the section goes on to acknowledge that some of the increase is due to increases in the value of assets at risk, it then invokes the NOAA Billion Dollar Dataset as evidence of extreme weather getting worse. Scientists have shown that this is an invalid metric (CWG 10.2) since it measures the growth of the economy not the frequency of extreme weather, and indeed NOAA has recently withdrawn the data product (Pielke Jr. 2024, 2025). Even though the dataset was still distributed by NOAA at the time of the NCA5, the report authors failed to assess it skeptically and see that it was unfit for the purpose of measuring climate trends.

Page 23 of the Overview states, in large font:

Climate changes are making it harder to maintain safe homes and healthy families; reliable public services; a sustainable economy; thriving ecosystems, cultures, and traditions; and strong communities.

It is pointless to try to evaluate this statement on scholarly grounds; it is self-evidently hyperbolic. This kind of language doesn’t belong in a scientific assessment report. Its prominent inclusion points not only to the willingness of NCA5 authors to promote alarm, but also the ineffectiveness of the review process in eliminating such statements.

3 OVERCONFIDENCE WHEN STATING CONCLUSIONS

3.1 Inflated certainty levels

Overconfidence in stating conclusions has been an endemic problem in NCA Reports. The authors frequently make sweeping generalizations without appropriate caveats or acknowledging uncertainties. The overconfidence begins with inflated language to describe certainty levels.

NCA5 uses specific terms to convey information about scientific confidence associated with important finds, observations and projections. The Front Matter of NCA5 states that

confidence in a finding is based on the type, amount, quality, strength, and consistency of evidence; the skill, range, and consistency of methods to detect, evaluate, attribute, and interpret climate trends; and the degree of agreement across scientific information sources.

and Table 1 from the Front Matter provides calibrated language for confidence assessment:

Very high:	Strong evidence (established theory, multiple sources, well documented and accepted methods, etc.). High consensus
High:	Moderate evidence (several sources, some consistency, methods vary and/or documentation limited, etc.). Medium consensus
Medium:	Suggestive evidence (a few sources, limited consistency, methods emerging, etc.) Competing schools of thought.
Low:	Inconclusive evidence (limited sources, extrapolations, inconsistent findings, poor documentation and/or methods not tested, etc.). Disagreement or lack of opinions among experts.

This terminology is obviously inflated: *high confidence* with just moderate evidence and medium consensus; *medium confidence* with only suggestive evidence and competing schools of thought. This inflation in terminology leads to overconfidence in conclusions.

Even with this inflated terminology, NCA5 further inflates the confidence level of many of its conclusions to well beyond what the IPCC has concluded with more thorough justification, and by incorrectly applying its own standards. An example is the conclusion about anthropogenic influence on climate change, arguably one of the most important scientific statements of the report.

Key Message 3.1 Traceable Account states:

There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have unequivocally caused *all* global warming observed over the industrial era.

while the corresponding statements from IPCC AR5 and AR6 are

AR5: It is *extremely likely* that *more than half* of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in greenhouse gas concentrations and other anthropogenic forcings together. (IPCC, 2013)

AR6: The *likely* range of total human-caused global surface temperature increase from 1850–1900 to 2010–2019 is 0.8°C to 1.3°C, with a best estimate of 1.07°C. It is *likely* that well-mixed GHGs contributed a warming of 1.0°C to 2.0°C, other human drivers (principally aerosols) contributed a cooling of 0.0°C to 0.8°C, natural drivers changed global surface temperature by –0.1°C to +0.1°C, and internal variability changed it by –0.2°C to +0.2°C. It is *very likely* that well-mixed GHGs were the main driver of tropospheric warming since 1979.

The IPCC AR5 and AR6 statements provide likelihood assessments but not a confidence level. While NCA5 claims with *very high confidence* that fossil fuels have unequivocally caused *all* global warming, AR5 refers to “*more than half* of the observed warming” and AR6 provides a more nuanced statement that relates to a *likely* range of warming contributed to by human drivers.

3.2 Overstating findings in underlying sources

Although we did not do a detailed audit of NCA5’s use of source material, spot checks suggest a pattern of overstatement.

Chapter 2 page 11 reports on an increase in precipitation in some areas and attributes it to “climate change”:

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

The claims were attributed to Knutson and Zeng (2018). But Knutson and Zeng did not say these things nor analyze this particular period. They said (emphasis added):

Observed annual precipitation trends over the recent 30-yr period 1981–2010 (Fig. 5) have generally stronger magnitudes (in mm yr⁻¹ decade⁻¹) than observed trends for 1901–2010 or 1951–2010. This is as expected since trends over a shorter period have stronger potential for occurrence of pronounced temporary trends due to internal variability alone. **Only 9% of the analyzed area has detectable and attributable anthropogenic influence (categories -3, -2, +2, +3), which represents less than one-third of the fractional areal coverage of such trends for 1901–2010 (29%).** ... Eight percent of the analyzed area has attributable anthropogenic *increases* (categories +2, +3), including parts of eastern Europe, northern Asia, northern Australia/Maritime Continent, and tropical Africa.

Thus for 1981–2010 they cautioned that observed changes are consistent with natural variability, and they did not claim attributable trends were observed over the United States.

As another example of overstating findings, NCA5's Chapter 2 page 18 states

There is robust evidence that human-caused warming has contributed to increases in the frequency and severity of the heaviest precipitation events across nearly 70% of the US.

This is apparently attributed to two papers Diffenbaugh *et al.* (2018) and Kirchmeier-Young and Zhang (2020). Diffenbaugh *et al.* presented ratios of observed occurrences of extreme events to simulated occurrence rates in CMIP6 models run with only natural forcings. They report that for 79% of the U.S., extreme rainfall events are currently more frequent than in simulations, and the ratio of occurrences will rise under future warming simulations. This is not “robust” evidence of anthropogenic influence since it requires readers to assume that climate models accurately simulate regional precipitation patterns, something that even IPCC AR6 admits is uncertain (AR6 WGI SPM Box SPM 1.2, SPM Section C.1.3).

Kirchmeier-Young and Zhang looked at extreme 1- and 5-day events in North America and, using three global climate models, found

A signal of combined anthropogenic and natural external forcing can be detected in the intensification of extreme precipitation at the continental scale over North America. In some cases, this intensification can be attributed to human influence specifically.

However, they noted large differences among the three models in their simulated precipitation changes, and two of the three models failed to yield attribution for 5-day events for the North America mean. In other words, the models disagreed on whether the observed changes were anthropogenic. Both of the cited references utilized the implausible RCP8.5 scenario and began their “historical” observational records only in 1961. Here again this is not “robust” evidence, it is merely suggestive, particularly since other studies have found natural variability predominant.

3.3 Technical example: Emergent constraints

Some of the overconfidence expressed by NCA5 arises by omitting discussion of counterevidence in the peer reviewed literature. An example is the topic of “emergent constraints”. Chapter 3 page 17 invokes this concept to support its claim that key uncertainties in climate model projections have been reduced:

An approach to reduce uncertainty in climate change projections has matured over the past decade. It is known as "emergent constraints." The term refers to strong statistical relationships between highly uncertain future climate parameters and observable trends or variations in the current climate, along with a physical explanation of this relationship.

Emergent constraints appeared in the climate modeling literature as an attempt to tie climate model behavior to climate observations in hopes of generating insight into real-world equilibrium climate sensitivity to a doubling of carbon dioxide (ECS). Climate models exhibit a wide range of ECS values. The idea of emergent constraints is to examine whether the models with shared sensitivity values also share a common representation of some climate process (usually related to clouds) that might influence ECS. Suppose, for instance, that in low-ECS models the total cloud fraction in the tropics is strongly correlated with that in the southern midlatitudes, but in high-ECS models the correlation is weak. Then researchers could examine whether the observed correlation is strong or weak and draw a conclusion about which type of model, and therefore which ECS value, is more likely.

A problem in the emergent constraint literature is that there has been a proliferation of proposed correlations with little physical motivation. NCA5 alludes to this in the Traceable Accounts section (p. 3-40) but not in the main Chapter text. As shown by Schlund *et al.* (2020) many emergent constraints patterned on CMIP5 models (Coupled Model Intercomparison Project No. 5, used for the IPCC 5th Assessment Report) failed to work on CMIP6 models (used for the IPCC 6th Assessment Report). In other words, the observed correlations in CMIP5 models between ECS and cloud processes failed to show up in CMIP6 models, indicating that they were likely spurious rather than clues to physical processes governing the climate system. As a result, emergent constraints estimated on CMIP5 models *increased* the uncertainty of ECS, rather than decreasing it as intended and as claimed by NCA5.

Schlund *et al.* summarized the problem as follows [**boldface** added for emphasis]

In this study, we systematically analyze 11 published emergent constraints on ECS that have mostly been derived from models participating in the Coupled Model Intercomparison Project Phase 5 (CMIP5) project... The focus of the study is on testing if these emergent constraints hold for [Earth System Models] participating in the new Phase 6 (CMIP6). Since none of the emergent constraints considered here have been derived using the CMIP6 ensemble, CMIP6 can be used for cross-checking of the emergent constraints on a new model ensemble. **The application of the emergent constraints to CMIP6 data shows a decrease in skill and statistical significance of the emergent relationship for nearly all constraints, with this decrease being large in many cases.** Consequently, the size of the constrained ECS ranges (66% confidence intervals) widens by 51% on average in CMIP6 compared to CMIP5.

Yet NCA5 described the use of emergent constraint analysis as an advance that reduced uncertainty of ECS and climate model projections (p. 3-38):

Emergent constraints have been widely applied to reduce the simulated spread in the climate feedbacks that shape climate sensitivity.

4 ARBITRARY AND AMBIGUOUS TREND ANALYSIS

In CWG25 Chapter 6 we discussed the need for care in the choice of time scale when making claims about trends in extreme weather. We provided examples from analysis of river flooding, heatwaves, and extreme precipitation to show how assertions about apparent trends based on short data sets fall apart when looking at longer versions of the same data sets. NCA5 uses varying time scales for trend discussions, especially in Chapter 2 (which is focused on trends), without explaining why shorter or longer intervals were chosen. For example, page 2-4 defines temperature trends with respect to the interval since the late 1800s whereas page 3-29 presents temperature trends over 1972-2021. Page 2-11 compares rainfall over the 2002-21 versus 1901-1960 intervals while page 2-18 uses the interval since the late 1950s to compute trends.

A further problem is that NCA5 uses term “trend” repeatedly without indicating if it is statistically significant (*i.e.* distinguishable from random variability); the ambiguity creates the impression all the observed changes were significant, but readers are left to speculate. All climate variables will, in principle, drift up or down over any particular time interval. Identifying the change as a trend requires showing that it is statistically significant using a variance estimator suitable for the type of data being analysed. Of particular importance is choosing a method robust to serial correlation which is frequently present in climate data. Throughout Chapters 1 to 3 references are made to “trends” without explaining how they were computed. The exception was on page 1-19 which refers to urban temperature trends being calculated using the Theil-Sen estimator, although that method does not seem to have been used elsewhere. The one case where reference is made to statistical significance was on Page 2-9 referring to a trend in Atmospheric Optical Depth but no explanation is given of how significance was determined. Page 2-19 refers to regional trends in droughts being “robust” but again fails to explain how the term was defined.

In this chapter when we refer to calculation of trends in precipitation, we use ordinary least squares to compute the linear trend over the entire sample length and we use the Vogelsang and Franses (2007) variance estimator which is robust to general forms of serial correlation.

4.1 Average and Extreme Precipitation

McKittrick and Christy (2019) showed that trends in U.S. average and extreme precipitation that appeared to be positive and significant over the NCA4 interval (1901 – 2016) lost significance and/or changed sign on longer samples (extending back as far as the 1840s, depending on location) or on a shorter interval coinciding with the final 40 years of the data then available (1978 – 2017). In CWG25 Section 6.4 we presented analyses of updated data for the same locations (and many others), in all cases finding both considerable regional heterogeneity and that trends detectable on one time scale are often not detected on longer or shorter time scales. These findings argue against simple attribution of changes to anthropogenic influences.

NCA5 did not continue the NCA4 precedent of using the post-1901 interval as the time scale for its precipitation discussion. Instead it refers to changes “since the 1950s”; NCA5 Figure 2.8 suggests 1958 might be the intended start date. Under Key Message 2.2 “Extreme Events Are Becoming More Frequent and Severe” (p. 2-16) NCA5 states (p. 2-18):

Rainfall is becoming more extreme

Since the 1950s, there has been an upward trend in heavy precipitation across the contiguous US. This increase is driven largely by more frequent precipitation extremes, with relatively smaller changes in their intensity.

In addition to our concerns that inferences about trends are contingent on choice of time scale, if the intended meaning of this statement is that positive and significant trends are found in heavy precipitation events across CONUS we cannot reproduce it. We supplemented the data used in CWG25 (McKittrick and Christy 2025a) with 61 stations across the Midwest (Christy 2025). Many post-1950 trends are positive but statistically insignificant depending on the measure of extreme precipitation. It is possible to find locations that positive and significant trends, such as the Southeast post-1950, but those results are not robust to selecting longer or shorter time scales of analysis nor do they generalize across all regions (see details in McKittrick and Christy 2025b).

The following is a more accurate summary of what U.S. precipitation data show.

There are regionally heterogeneous changes in average and extreme precipitation. Positive trends in annual average rainfall and extreme events (defined either as the annual maximum or the number of exceedances of the 99th percentile value) are generally weak or non-existent when looking at samples exceeding 130 years in length. Significant trends can be found when beginning the sample in the 1950s although in most cases the trends weaken and become insignificant when looking at the post-1980 interval. This argues against attribution of changes in precipitation to anthropogenic warming.

4.2 Heatwaves

In contrast to NCA5, NCA4 examined heat extremes across the entire 20th century, pointing out that peak heat wave activity was reached in the 1930s and has decreased since then, and that recent increases are confined to areas west of the Rockies. NCA4 stated:

[The] warmest daily temperature of the year increased in some parts of the West over the past century, but there were decreases in almost all locations east of the Rocky Mountains. In fact, all eastern regions experienced a net decrease, most notably the Midwest (about 2.2°F [1.2°C]) and the Southeast (roughly 1.5°F [0.8°C]).

Since the mid-1960s, there has been only a very slight increase in the warmest daily temperature of the year (amidst large interannual variability). Heat waves (6-day periods with a maximum temperature above the 90th percentile for 1961–1990) increased in frequency until the mid-1930s, became considerably less common through the mid-1960s, and increased in frequency again thereafter. As with warm daily temperatures, heat wave magnitude reached a maximum in the 1930s.
(NCA4 pp. 190-191)

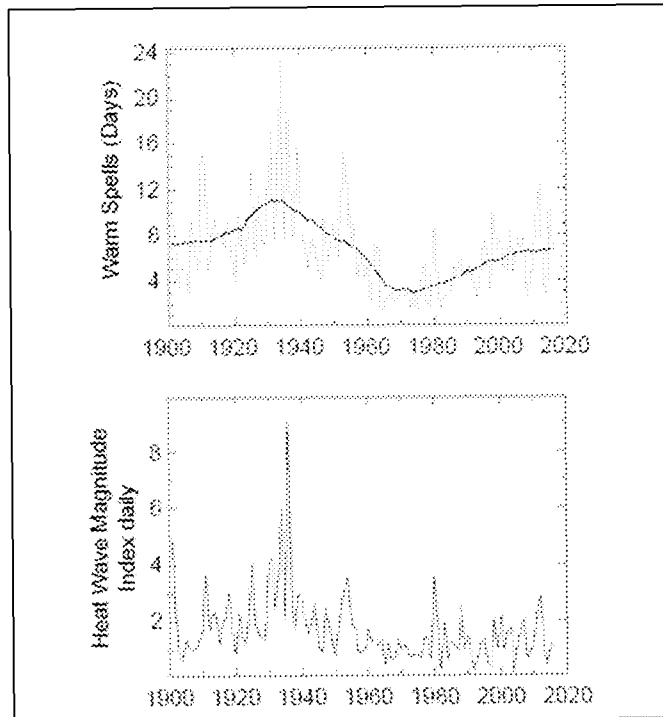


FIGURE 3. U.S. Heat waves since 1900. Reproduction of NCA4 Figure 6.4

Contrast this careful and factual language from NCA4 with NCA5 Key Message 2.2: “Extreme Events Are Becoming More Frequent and Severe.” This blanket statement is followed by NCA5 Figure 2.7 (reproduced as Figure 4 below) which shows the number of hot days, cold days and warm nights (respectively in panels a—c) over the period 2002-2021 compared to 1901-1960. [Presumably these are annual counts, although not stated in the caption.]

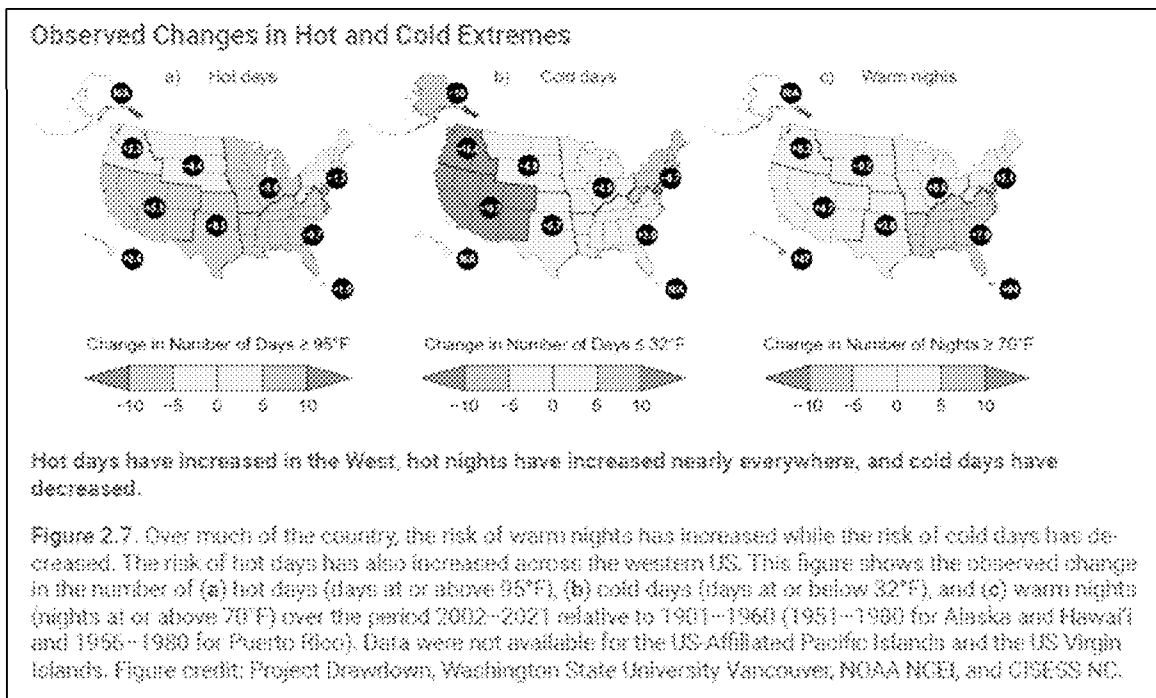


FIGURE 4: Reproduction of NCA5 Figure 2.7.

Close inspection shows that this figure actually contradicts the NCA5 Key Message with respect to heatwaves and instead reinforces the position of NCA4. Notwithstanding Key Message 2.2, the leftmost panel in NCA5 Figure 2.7 above shows that over most of CONUS the number of extreme heat days has *decreased* in recent decades compared to the prior century.

The accompanying discussion in NCA5 becomes convoluted as it appears to be aimed at supporting the Key Message despite the contrary evidence. NCA5 Chapter 2 elaborates on Key Message 2.2 by stating (page 16):

Observations show an increase in the severity, extent, and/or frequency of multiple types of extreme events. Heatwaves have become more common and severe in the West since the 1980s (*high confidence*).

But while it mentions the increase in hot days in the West, it fails to mention the decrease everywhere east of the Rockies. On the next page (page 17) it raises the comparison to the 1930s and then switches to discussing global counts:

By some measures, the most extreme heatwaves on record in the United States occurred during the Dust Bowl era of the 1930s. ... Globally such heatwaves are becoming more frequent, and in recent decades the western United States has been following those trends.

The reference to a global trend seems to be an attempt to tie heatwaves to anthropogenic climate change. But the obvious question, unaddressed by NCA5, is why one region follows the global pattern of increasing heatwaves while most of the country is trending in the opposite direction. These issues are addressed in Chapter 6 of CWG25, demonstrating that the range and magnitude of extreme temperatures (10s of degrees) are driven more by natural variability than by the small anthropogenic forcing. The analysis in CWG25 shows that for both (a) hot days ($\geq 95^{\circ}\text{F}$) and (b) number of days in heatwaves, the current decade is no hotter than a century ago in the U.S. Thus, the NCA5 claim that

“multiday heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades,” is simply false when expanding the temporal and spatial domains to encompass all available data (Chapter 6 and Figure 6.3.6 of CWG25).

NCA5 then pointed to the dramatic Pacific Northwest heatwave of 2021. CWG2025 Section 8.6.1 discussed this event in detail, reviewing the multiple peer reviewed studies that explained the unusual meteorological context was unrelated to human-caused climate change, a point omitted from the NCA5 discussion.

NCA5 finally addresses the declining heatwave trend in CONUS east of the Rockies but attempts to reframe it by focusing on urban warm spells.

[The] number of very hot days has actually decreased across the central and eastern regions due to summer cooling trends in the region (Figure 2.7; Ch. 22). This does not, however, mean the central and eastern US are not affected by heat. The impacts of extreme high temperatures are more severe if such conditions persist for several days, and overall, multiday heatwaves have become hotter, more frequent, larger, and longer lasting in recent decades. Across 50 large US cities, the US Global Change Research Program heatwave indicator (<https://www.globalchange.gov/indicators/heat-waves>) shows that the average number of heatwaves has doubled since the 1980s, and the length of the heatwave season has increased from about 40 days to about 70 days.

We discussed this part of NCA5 in CWG25 Section 6.3. The figure referenced by NCA5 uses a short time period which begins in the 1960s, the coldest decade in the last 100 years, thus suppressing any comparison to the 1930s. Further, nighttime temperatures in urban areas have increased faster than daytime temperatures (which NCA5 acknowledges), but this is a signature of urban heat islands and not a good metric of climate change. CWG25 found that the occurrence of hot days ($\geq 95^{\circ}$ F) has recently increased in the West, but declined in the remainder of the country, and in the nationwide average, since 1899.

5 INADEQUATE TRACEABLE ACCOUNTS

NCA3 began the practice of including a section on Traceable Accounts at the end of each chapter. This is the description from NCA5:

Each chapter concludes with a section entitled Traceable Accounts, which provides information on the overall process used to develop the chapter as well as a separate Traceable Account section for each Key Message. These Traceable Accounts describe the supporting evidence behind each Key Message, the process and rationale authors used in reaching their conclusions, and the author team’s expert assessment of the confidence in and, where applicable, likelihood of these conclusions. As such, Traceable Accounts provide information about the state of the science, document sources of uncertainty, identify research gaps, and allow traceability to data and resources.

The Traceable Accounts for each Key Message includes the following sections:

- Description of Evidence Base

- Major Uncertainties and Research Gaps
- Description of Confidence and Likelihood

The Traceable Accounts could have addressed the statutory requirement that the NCA discuss scientific uncertainties. They could also help satisfy the Executive Order for Restoring Gold Standard Science by addressing reproducibility, transparency, communication of error and uncertainty, and skepticism of findings and assumptions. However, the Traceable Accounts in NCA5's Chapters 2 and 3 are uneven, often superficial and uninformative.

An example of a deficient Traceable Account is NCA5's Key Message 2.2: "Extreme Events are Becoming More Frequent and Severe". The "Description of the Evidence Base" offers two paragraphs, the first summarizing the findings and the second generically describing the types of data that can be used for storms. "Major Uncertainties and Research Gaps" focuses on the uneven distribution across U.S. populations due to differences in exposure and vulnerability. The only limitations in data referred to are the lack of a long-term record of lightning and the lack of homogenized daily and hourly temperature data apart from reanalysis products.

But the most astonishing deficiency is in the "Description of Confidence and Likelihood." One of the statements in Key Message 2.2 is:

Hurricanes have been intensifying more rapidly since the 1980s (*high confidence*) and causing heavier rainfall and higher storm surges (*high confidence*).

The Description of Confidence and Likelihood includes the following statement:

Basic physical understanding and climate models both provide robust explanations for the links between climate change and observed changes in these extremes: this is why the authors also have high confidence that storms are delivering more rainfall and high confidence that storm surges are becoming higher.

No reference to journal publications or a specific data set is made anywhere in the chapter regarding hurricane-induced precipitation or storm surge to support this *high confidence* conclusion.

The Traceable Accounts for the various Key Findings of Chapter 3 have some substantial inconsistencies. Consider

Key Message 3-1: Human activities have caused global warming.
Confidence and Likelihood: "There is *very high confidence* that emissions of GHGs from human activities, fossil fuel use in particular, have *unequivocally* caused all global warming observed over the industrial era. There is also *very high confidence* that changes in natural climate drivers have had globally small and regionally variable long-term effects over this period."

The Uncertainties section addresses only uncertainties in radiative forcing by greenhouse gases, ignoring the great uncertainty in model response (CWG25 Chapters 4&5) In contrast, the Traceability Analysis of Key Message 3-4 ("Humans Are Changing Earth System Processes") raises the problem that relatively little is known about the role of natural variability at the regional scale. From its Description of Evidence Base:

In the last decade, there has been increasing recognition of the role of regional-scale natural variability in the past and future evolution of climate, as well as the fact that regional natural variability signals can be competitive with forced anthropogenic signals.

And from its Major Uncertainties and Research Gaps:

For example, the true natural variability of the climate system on decadal to centennial timescales could be larger than what we estimate from GCMs, which would further increase the irreducible uncertainty stemming from natural variability.

These statements are among the most scientifically credible in the entire NCA5 and they directly undercut the confidence assigned to Key Message 3-1.

There is also a generic problem in tracing NCA5's Traceable Accounts. The Front Matter of NCA5 states:

Each figure and some tables are accompanied by a metadata survey, which can be accessed in the online version of the report by clicking on the eyeball icon above the figure or table (see the table below for explanations of additional icons used throughout the report). The metadata survey describes data sources, figure or table development methods, copyright information, and other important documentation.

Clicking on the 'eyeball' icon does not reveal the metadata information; instead a "Contact Us" email appears, addressed to the USGCRP. This is an inadequate way to archive the metadata information.

In summary, the Traceable Analyses examined here, with few exceptions, fail to meet the stated objectives of the NCA.

6 OVEREMPHASIS ON EXTREME SCENARIOS

To respond to the GCRA mandate to "project major trends for the subsequent 25 to 100 years," NCA5 relies on projections of future climate change based on estimates of future emissions (the so-called SSP scenarios) and/or specified levels of radiative forcing (the RCP scenarios). For the most part, NCA5 uses scenarios developed for the IPCC Assessment Reports.

In CWG Section 3.2.1 we presented a critical assessment of past and current IPCC scenario envelopes, showing that they have tended to overshoot observed emissions. IPCC AR6 published in 2021 stated that "The likelihood of high-emission scenarios like RCP8.5 and SSP5-8.5 is considered low in light of recent energy sector developments." and that same year UN Climate Negotiators (COP) stopped using scenarios above 4.5.

NCA5 makes the following observations about the scenarios they use:

NCA5 authors were advised to assess the full range of scenarios available. (Front Matter)

Scenarios of future emissions and land-use change are developed as plausible alternatives, but no relative likelihood is attached to them. Some recent studies, however, have argued that

the highest scenario, SSP5-8.5, is no longer plausible without a reversal of current trends in the adoption of renewables and energy efficiency. (Key Message 3.3 Traceable Analysis)

Despite acknowledging the issue, NCA5 otherwise ignored the problem. A keyword search of NCA5 of mentions of RCP/SSP scenarios finds over 50% referred to the extreme emissions scenarios RCP8.5/SSP5-8.5. Further, nine NCA5 figures (5.2, 6.9, 7.4, 11.3, 14.6, 22.13, 22.19, 27.9, 29.13) included *only* the 8.5 scenarios.

The problem of relying on extreme scenarios is particularly acute for NCA5's sea level rise projections. The sea level rise scenarios used in NCA5 do not relate directly to the SSP emissions scenarios, but rather to specified amounts of sea level rise by 2100. Table 4 of NCA5's "Guide to Using this Report" reproduced below shows that Low relates to 0.3 m (0.98 feet), Intermediate-Low relates to 0.5 m (1.64 feet), Intermediate relates to 1.0 m (3.28 feet), Intermediate-High relates to 1.5 m (4.92 feet), and High relates to 2.0 m (6.56 feet).

Table 4. Descriptive Terms for Common Sea Level Rise Scenarios Used in NCA5						
Future global mean sea level rise and sea level rise along United States coastline are shown for five scenarios in feet (and meters), relative to a 2000 baseline. The US values shown in the right half of the table are averaged across the US coastal regions, including the contiguous US, Alaska, Hawaii, and the US-Affiliated Pacific Islands, and the US Caribbean. The national values shown in the table differ substantially from regional values. For example, sea level rise is higher in the Gulf Coast and lower or even negative in some parts of Alaska. In the next 30 years (2020–2050), sea level along the contiguous US coasts is expected to rise 0.92 feet (0.28 m), the same amount of sea level rise observed over the last 100 years (1920–2020). See Chapter 9 for regional sea level information. Adapted from Sweet et al. 2022.”						
Sea Level Rise Scenario Descriptor	Global Mean Sea Level			United States		
Year	2050	2100	2150	2050	2100	2150
Low	0.49 (0.15)	0.98 (0.3)	1.31 (0.4)	0.59 (0.18)	0.98 (0.3)	1.64 (0.5)
Intermediate-Low	0.66 (0.20)	1.64 (0.5)	2.62 (0.8)	0.75 (0.23)	1.64 (0.5)	2.95 (0.9)
Intermediate	0.92 (0.28)	3.28 (1.0)	6.23 (1.9)	0.89 (0.27)	3.28 (1.0)	6.89 (2.1)
Intermediate-High	1.21 (0.37)	4.92 (1.5)	8.86 (2.7)	1.12 (0.34)	4.92 (1.5)	8.86 (2.7)
High	1.41 (0.43)	6.56 (2.0)	12.14 (3.7)	1.38 (0.42)	6.56 (2.0)	12.46 (3.8)

TABLE 1: Reproduction of Table 4 from the Front Matter of NCA5

Considering only projections representing processes quantified with at least medium confidence, IPCC AR6 assessed global mean sea level projections for all emissions scenarios (including implausible extreme emissions scenarios) for 2100 to fall between 0.2 and 1.6 m (5th—95th percentile range). Nevertheless, the range of sea level rise scenarios considered by NCA5 extends to 2.0 m. Further, NCA5 fails to include plausible lower scenarios, such as 0.2 m cited by the IPCC, which also corresponds to the average rate of sea level rise over the past century.

Chapter 9 of NCA5 offers the following predictions of sea level rise:

“Under a range of potential global warming levels, average sea level along US coastlines is *likely* to be between 12 and 20 inches above 2000 sea levels in 2050 (Figure 9.2).”

The projected sea level rise values span from the Intermediate scenario to values slightly greater than the High scenario. They can be put into context by considering the observed global sea level rise from 2000-2024, which is only approximately 3.4 inches (0.28 feet). **NCA5 is thus projecting a sea level rise during 2025 and 2050 that is 3.5 to 5.8 times the rate observed during 2000-2024, an exceedingly implausible outcome.** Chapter 9 further states:

“Looking toward the future, an 11 inch (28 cm) average rise along the contiguous US coastline is expected by 2050 (relative to 2020), with a *likely* range of 9-13 inches.”

...

“There is *high confidence* and it is *likely* that sea levels will rise about 11 inches (likely range of about 9–13 inches) between 2020 and 2050”

In summary, NCA5 presents future sea level rise scenarios that are not directly relatable to either SSP/RCP emissions scenarios or to plausible global warming levels. The NCA5 scenarios include two that are higher than the 95th percentile for the extreme emissions scenario RCP8.5 and include hypothesized ice sheet processes in which there is low confidence. Projections to 2050 require rates of sea level rise from 2025 to 2050 that are more than triple the rate observed during 2000-2024. Further, NCA5 ascribes *high confidence* to these sea level rise projections. CWG25 Section 7.3 provides further context for USGCRP projections of extraordinary sea level rise in the next 25 years.

More generally, NCA5’s inclusion of, and even focus on, implausible extreme scenarios supports projections of alarming impacts that are very unlikely to be driven by anthropogenic warming.

7 CONFLATION OF NATURAL AND ANTHROPOGENIC CLIMATE CHANGES

NCA5’s Glossary defines “climate change” as a change in climate for any reason. This is technically correct, but at variance with the (now) popular perception of all climate changes being anthropogenic. The distinction is not academic- it is central both to attribution questions and to projections, since anthropogenic changes would respond to mitigation, while natural changes are unavoidable.

The discussion on NCA5 page 2-4 begins “Human activities are changing the climate”, then goes on to list evidence for anthropogenic GHG emissions and climate warming. The next paragraph begins “Climate change is happening now in the United States. Including Alaska, the continental US has been warming about 60% faster than the planet as a whole since 1970.” In context the implication is that the warming of CONUS faster than the planetary average is an effect of GHG emissions. But it is an artifact of the Earth’s surface being 70 percent ocean. Since the ocean warms more slowly than land, comparison of any land surface outside the tropics with the global average would show the land surface to be warming faster than the global average, regardless of the cause of the warming.

The same page goes on to say “Climate change is already affecting people in the United States. Extreme heat was estimated to be responsible for more than 700 deaths per year between 2004 and 2018 although some estimates put heat-related mortality closer to 1,300 deaths annually.” But extreme heat, whether natural or not, has always been a risk to human health. As to trends, the data show that adaptation has caused the mortality burden of extreme heat to drop substantially in recent decades (CWG25 Section 10.3.1).

Consider also the NCA5 statement on precipitation that we cited in Section 3.2:

Many eastern regions of the country are getting wetter (Figure 2.4). Average annual precipitation from 2002-2021 was 5%-15% higher relative to the 1901-1960 average in the central and eastern US, a trend attributable to climate change.

The attribution is superfluous because the statement is a tautology by NCA5's definition of climate change. But its gratuitous inclusion effectively attributes the observed trend to greenhouse gas emissions.

Exploitation of the ambiguity in "climate change" is endemic to NCA5. The NASEM review (pp. 23-24) commented on this problem as follows:

The draft NCA5 report frequently describes "change" but does not consistently distinguish between natural variability and climate change. This lack of clarity can be misleading for the reader by creating the misconception that some impacts that are the result of the combination of natural variability and climate change are instead solely due to climate change... it is important for NCA5 authors to accurately identify the multiple drivers of change (including global change), in addition to climate change, and accurately attribute impacts. Clearly describing impacts due to natural variability, climate change, or a combination of the two is important not only for informing policy decisions, but also for building public understand and trust in the report's messages. Climate change and natural variability should be clearly defined in the glossary and natural variability could be introduced in chapter introductions when the concept is important for understanding key messages.

This could have been easily addressed by reserving the term "climate change" for anthropogenic changes and using "climate variability" for natural changes. But the NCA5 authors seemingly ignored their recommendation.

A separate but related issue is use of the term "climate change" to refer to increases in socioeconomic vulnerabilities that have anthropogenic but non-GHG-related causes. NCA5 page 1-19 states "Climate change exacerbates inequalities." But the issue discussed is the negative correlation between neighborhood-level income and land surface temperatures (LST) in urban areas. To the extent the correlation is real the most likely explanation is that low-income households concentrate where housing is less expensive, which may be in neighborhoods with less nearby parkland and tree cover, which has nothing to do with CO₂ emissions. Similarly the NCA5 makes repeated reference to the Billion Dollar Disaster dataset which is dominated by trends in population and economic growth, as we discussed in CWG25 Section 10.2.

8 SUMMARY EVALUATION OF NCA5 AND RECOMMENDATIONS FOR NCA6

This chapter summarizes our evaluation of NCA5 relative to OSTP's charge: whether NCA5 (1) complied with the USGCRP's statutory obligation; (2) adheres to the core tenets of Gold Standard Science; and (3) can suitably inform federal climate and energy policy. The points made in this summary analysis refer to specific sections of this report as well as to the CWG25 report.

8.1 Compliance with USGCRP's statutory obligation

As cited in Section 1.2 of this report, the Global Change Research Act requires an assessment that:

- (1) integrates, evaluates, and interprets the findings of the [Global Change Research] Program and discusses the scientific uncertainties associated with such findings;
- (2) analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity; and
- (3) analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

We deem NCA5 to have fallen short when evaluated against these criteria because of the following major shortcomings (each is detailed in the chapters cited):

- Inadequate assessment of the relevant topics in climate science and the hazard components of climate impacts (such as hurricanes and floods). NCA5 instead focuses on evaluation of societal vulnerabilities (such as flood infrastructure, access to air conditioning, etc.), “Climate Action,” and policy recommendations with a social justice emphasis (Section 1.2).
- Overconfidence in conclusions and inadequate assessment of uncertainties (Section 3.1.5)
- Inadequate discrimination between natural and human-induced causes of trends and impacts (Chapter 7)
- Inadequate analysis of climate trends by relying on short time periods (Chapter 6)
- Uncritical evaluation of emission scenarios and climate simulations in making projections for the next 25 to 100 years (Chapter 6; Section 3.2.1 and Chapter 5 of CWG25).

8.2 Adherence to the tenets of Gold Standard Science

With respect to the tenets of Gold Standard science listed in Section 1.2 of this report, we have identified the following major shortcomings in NCA5:

- **Lack of reproducibility.** In the few examples that we examined closely, we identified an instance where we could not reproduce the findings of the NCA5, a task that should require only rudimentary data analysis (Section 4.1)
- **Lack of transparency.** In many instances, the Traceable Account fails to justify the Key Finding. Metadata was not readily accessible. (Chapter 5)
- **Inadequate communication of error and uncertainty.** The Traceable Account for each Key Message provides a section on Major Uncertainties and Research Gaps; most of the accounts that we examined were superficial and uninformative. (Chapter 5)
- **Not skeptical of findings and assumptions.** The main text of the chapters is, with few exceptions, not skeptical of its findings and assumptions. (Chapters 3, 5)
- **Some hypotheses and Key Messages are not falsifiable.** Key Message 13.4 is but one of many examples: “Equitable Distribution of Transportation Trade-offs and Benefits Requires Community Involvement.”
- **Failure to acknowledge benefits** of warming and additional atmospheric CO₂ (CWG25 Section 2.1, Chapter 9)
- **Inadequacy of the peer review process.** The review of the NCA5 Third Order Draft by National Academies of Science, Engineering and Medicine (NASEM) identified some of the deficiencies we have noted, but the NCA5 authors were not obligated to adopt the NASEM recommendations. More importantly, we’ve identified many other deficiencies in NCA5; the NASEM review did not point them out and thus lacked the rigor expected of NASEM reports. (Section 1.4, Chapter 7)

8.3 Suitability for informing Federal climate and energy policy

We assess that the selection and presentation of information in NCA5 makes it an unreliable basis for U.S. climate and energy policymaking. For each of the elements of knowledge characterization suitable for risk management listed in Section 1.3, here are specific examples where NCA5 falls short:

- The degree to which the assumptions made are reasonable/realistic based on background knowledge
 - NCA5 focused on implausibly extreme scenarios for emissions and sea level rise scenarios and made policy recommendations without adequate consideration of the costs
- The degree to which data/information exists and are reliable and relevant
 - NCA5's assumptions about model reliability, and its use of short time periods for analysis, does not support its high-confidence conclusions
- The degree to which there is disagreement among experts, including those from different environments or academic fields
 - While NCA5 was an interdisciplinary effort, the concerns we have raised all point to a failure to canvass or communicate the full range of evidence including data and research findings that speak against Key Messages.
- The degree to which the phenomena involved are understood and accurate models exist
 - NCA5 is not appropriately skeptical of the ability of climate models to attribute the causes of warming and extreme events or to project future climates
- The degree to which the knowledge has been thoroughly examined with respect to unknown knowns
 - A major NCA5 shortcoming is its dismissal of natural climate variability in many contexts where it should have been a major consideration

NCA5 is also problematic for informing policy because its hyperbolic language promotes alarm and advocates for specific policies without proper analysis of marginal costs and benefits. In recent decades, climate science has engendered passion and emotion. Indeed, some younger climate scientists have gone into the field to “save the planet.” The NASEM Review of the NCA5 underscores the endemic nature of this problem - their review appears to be written by authors who share many of the biases of the NCA5 team, with an inordinate focus on social and policy issues. It is then not surprising that objectivity can suffer when climate scientists communicate their understanding to non-experts. Further, the field of climate science has been politicized by NetZero mandates. This lack of objectivity usurps the public's right to make informed choices and undermines their confidence in the scientific enterprise.

Philip Handler, President of the National Academy of Sciences, identified the problem forty-five years ago in an [editorial](#) that still resonates:

Difficulty arises in the scientific community from confusion of the role of scientist *qua* scientist with that of scientist as citizen, confusion of the ethical code of the scientist with the obligation of the citizen, blurring the distinction between intrinsically scientific and intrinsically political questions. When scientists fail to recognize these boundaries, their own ideological beliefs, usually unspoken, easily becloud seemingly scientific debate.

8.4 Recommendations for NCA6

While we have assessed NCA5 to be scientifically inadequate and unsuitable as a basis for decision-making, one can imagine a different National Climate Assessment that meets statutory and policymaker requirements. The goal should be not to persuade, but to impart understanding by being objective, transparent and complete. A suitable NCA would be an important complement to IPCC assessments to the extent that its analysis and conclusions differed from the oracular “consensus” of the IPCC reports and additional topics are addressed. Such a report would promote a more open scientific discussion and a more informed policy debate.

We recommend that the NCA6 have a narrower scope than NCA5, refocusing on climate science, including natural climate variability, with topics to include:

- How the climate has changed in the past. The U.S. has the best and longest meteorological records and they should be examined and displayed in their entirety. Trend analyses should include longest periods available and employ suitable statistical methods. Local paleoclimate data should be considered where available. Analysis should demonstrate not only how the climate has varied and changed, but also regional heterogeneity. Standard, easily understandable metrics should be employed.
- The range of climatic and weather conditions, including extremes, that have occurred in the past and can reasonably be expected to occur in U.S. regions over the near future.
- A critical survey of current global and regional modeling capabilities and their suitability for regional impact assessments and projections. This would include an assessment of their ability to reproduce observed changes. It should also discuss alternative methods for generating projections and forecasts on regional and decadal scales, along the lines of Chapter 10 of the IPCC AR6 WGI Report.
- Assessment of the impacts of recent historical climate variability and change on ecosystems and society. Where long-term data indicate a detectable regional change, regional projections can be made for the period 2030-2050. Emissions scenarios exceeding RCP4.5/SSP2-4.5 and ECS values exceeding 4°C should not be used. Regional projections to 2100 have no credibility at this time.

It is important that climate projections be assessed in context of current science capabilities. The pressures toward spatially or temporally precise projections should be resisted as the current models are nowhere up to the task (an example is discussed in CWG25 Section 5.8). In that light, the many pages of NCA5 devoted to projected regional and sectoral impacts have little value.

Given the substantial deficiencies in NCA5 that we have identified, along with the endemic bias of the climate community towards alarmism and policy advocacy, producing an objective NCA6 report with the current NCA organizational construct would be a challenge. A NASEM review could help, but only if the selected participants reflect full viewpoint diversity and do not simply mirror the assumptions and biases of past NCA teams. We regard the CWG25 report to be a good start on NCA6 in terms of scope and objectivity, including adherence to the tenets of Gold Standard Science.

More broadly, we recommend a rewrite of the Global Change Research Act. The current mandate is vague and off point, allowing successive NCA teams to interpret the mandate as they see fit. Moreover, it is becoming increasingly clear that current and foreseeable models are not fit-for-purpose to describe regional climates, let alone usefully project them for 25 and 100 years. Further, the use of the term “global change” is ambiguous and outdated.

9 REFERENCES

- Aven, Terje (2017) "Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices," *Reliability Engineering & System Safety* 167 (November 2017): 42–48
<https://www.sciencedirect.com/science/article/pii/S0951832016306950>
- Christy, John (2025) Precipitation Data Archive for Midwest Stations.
https://www.nsstc.uah.edu/data/ushcn_jrc/US_MidW_61stn_dly_ppt_1893_2024_250704.xlsx
- Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.
- Dellawalla, Colette, Victor Ambrose, Carl Bergstrom *et al.* (2025) "Trump's new 'gold standard' rule will destroy American science as we know it." *The Guardian* May 29, 2025
<https://www.theguardian.com/commentisfree/2025/may/29/trump-american-science>
- Diffenbaugh, N.S., D. Singh, and J.S. Mankin, 2018: Unprecedented climate events: Historical changes, aspirational targets, and national commitments. *Science Advances*, 4 (2), 3354.
<https://doi.org/10.1126/sciadv.aao3354>
- Handler, Philip (1980) Public Doubts About Science. *Science* 208(4448) p. 1093
<https://www.science.org/doi/10.1126/science.208.4448.1093>
- Kirchmeier-Young, M.C. and X. Zhang, 2020: Human influence has intensified extreme precipitation in North America. *Proceedings of the National Academy of Sciences of the United States of America*, 117 (24), 13308-13313. <https://doi.org/10.1073/pnas.1921628117>
- Knutson, Thomas and Fanrong Zeng (2018) "Model Assessment of Observed Precipitation Trends over Land Regions: Detectable Human Influences and Possible Low Bias in Model Trends" *Journal of Climate* 31(12) <https://journals.ametsoc.org/view/journals/clim/31/12/jcli-d-17-0672.1.xml>
- Koonin, Steven (2024) *Unsettled: What Climate Science Tells Us, What It Doesn't, and Why It Matters*. New York: Basic Books.
- McKittrick, R., and J.R. Christy (2019). Assessing changes in US regional precipitation on multiple time scales. *Journal of Hydrology*, 578, 124074. <https://doi.org/10.1016/j.jhydrol.2019.124074>
- McKittrick, R. and J.R. Christy (2025a), "Data and Code for CWG2025 Report", Mendeley Data, V1, doi: 10.17632/by76s7rxfb.1
- McKittrick, R., and J.R. Christy (2025b) "Supplement to NCA5 Critique: Examining the reproducibility of NCA5 claim of extreme precipitation trends." Available online at https://www.nsstc.uah.edu/data/ushcn_jrc/SI.Precip_trends_reproducing.pdf
- National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press.
<https://doi.org/10.17226/26757>.
- NCA4. (2017). *Climate science special report: Fourth National Climate Assessment, Volume I* (D. J. Wuebbles, D. W. Fahey, and K. A. Hibbard, Eds.). U.S. Global Change Research Program.
<https://doi.org/10.7930/I0J964J6>
- NCA5. (2023). *Fifth National Climate Assessment* (A. R. Crimmins *et al.*, Eds.). U.S. Global Change Research Program. <https://doi.org/10.7930/NCA5.2023.CH1>
- Pielke Jr., R. (2024). Scientific integrity and U.S. 'billion dollar disasters'. *npj Natural Hazards*, 1, Article 12. <https://www.nature.com/articles/s44304-024-00011-0>
- Pielke Jr., R. (2025, May 8). RIP NOAA's billion dollar disasters. The Honest Broker [Substack].
<https://rogerpielkejr.substack.com/p/rip-noaas-billion-dollar-disasters>

Schlund, Manuel, Axel Lauer, Pierre Gentine, Steven C. Sherwood, and Veronika Eyring (2020)
Emergent constraints on equilibrium climate sensitivity in CMIP5: do they hold for CMIP6?
Earth System Dynamics 11 1233-1258 <https://doi.org/10.5194/esd-11-1233-2020>

APPENDICES

APPENDIX 1: Charge to the review

ABOUT THE AUTHORS

[Insert updated bios]

John Christy
Ross McKittrick

July 3, 2025

Supplement to NCA5 Critique: Examining the reproducibility of NCA5 claim of extreme precipitation trends

NCA5 states (p. 2-18):

Rainfall is becoming more extreme

Since the 1950s, there has been an upward trend in heavy precipitation across the contiguous US. This increase is driven largely by more frequent precipitation extremes, with relatively smaller changes in their intensity.

We attempted to verify this statement using long term U.S. precipitation records for the three regions discussed in CWG25 Section 6.4 (Pacific Coast, Southeast and Northeast) supplemented with the Midwest. We applied the methodology of McKittrick and Christy (2019), namely linear OLS trends with standard errors computed using the method of Vogelsang and Franses (2007) which is robust to general forms of serial correlation. Data are available at McKittrick and Christy (2025; NE, SE, PC) and Christy (2025; MW). Methods as described in McKittrick and Christy (2019), code available at McKittrick and Christy (2025).

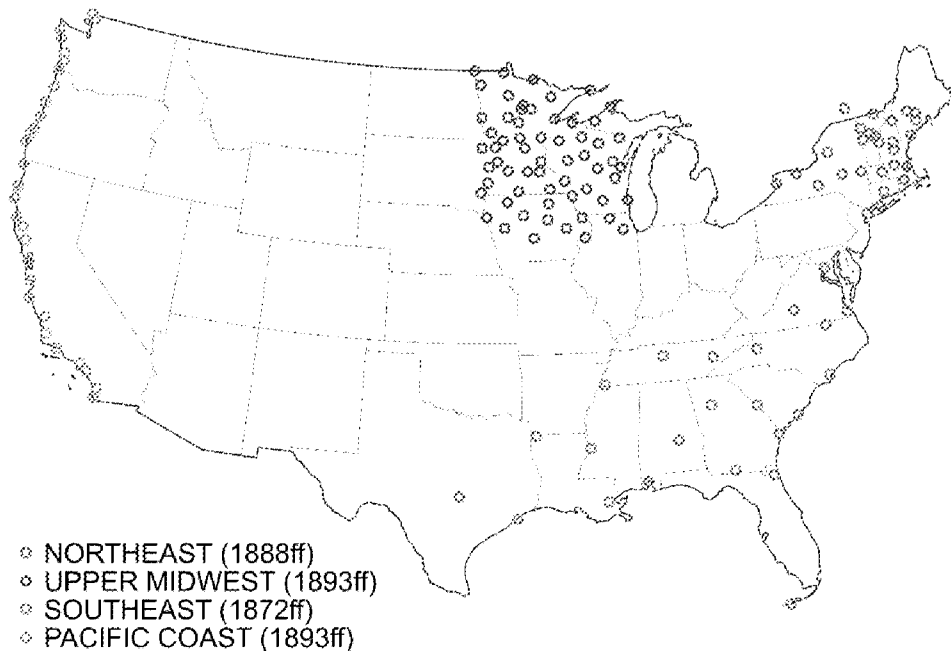


Figure S1: Stations used in the following analyses

In the Tables that follow the result codes are:

(-) neg insignificant, -- neg significant, (+) pos insignificant, ++ pos significant.

The Table columns are:

Column 1: Measure

Column 2: Number of stations in that region

Column 3: Count of stations exhibiting a significant positive trend

Column 3: Count of stations exhibiting a significant negative trend

Column 5: Characteristic of region-wide trend

PACIFIC COAST

Since 1893:

	No. stns	+ trends	- trends	region
1-day total	29	0	1	(-)
2-day total	29	0	1	(-)
Avg on non-zero days	29	0	9	--
Variability	29	1	0	(+)
Annual max	29	2	1	(+)
Number of 99 th pct exceedances	29	1	0	(-)

Since 1950:

	No. stns	+ trends	- trends	region
1-day total	29	0	1	(-)
2-day total	29	0	1	(-)
Avg on non-zero days	29	0	4	(-)
Variability	29	2	3	(-)
Annual max	29	6	3	(-)
Number of 99 th pct exceedances	29	2	1	(-)

Since 1980:

	No. stns	+ trends	- trends	region
1-day total	29	0	0	(-)
2-day total	29	0	0	(-)
Avg on non-zero days	29	0	1	(-)
Variability	29	0	0	(-)
Annual max	29	2	1	(-)
Number of 99 th pct exceedances	29	0	0	(+)

SOUTHEAST

Since 1873:

	No. stns	+ trends	- trends	region
1-day total	24	1	1	(+)
2-day total	24	1	1	(+)
Avg on non-zero days	24	7	2	(+)
Variability	24	1	0	(+)
Annual max	24	2	0	(+)
Number of 99 th pct exceedances	24	5	0	(+)

Since 1950:

	No. stns	+ trends	- trends	region
1-day total	24	5	0	++
2-day total	24	5	0	++
Avg on non-zero days	24	5	1	++
Variability	24	6	0	++
Annual max	24	4	0	++
Number of 99 th pct exceedances	24	4	0	(+)

Since 1980:

	No. stns	+ trends	- trends	region
1-day total	24	5	0	(+)
2-day total	24	5	0	(+)
Avg on non-zero days	24	5	1	(+)
Variability	24	3	0	(+)
Annual max	24	4	0	(+)
Number of 99 th pct exceedances	24	4	0	(+)

MIDWEST

Since 1893:

	No. stns	+ trends	- trends	region
1-day total	61	23	0	++
2-day total	61	23	0	++
Avg on non-zero days	61	2	12	(+)
Variability	61	12	0	++
Annual max	61	9	0	(+)
Number of 99 th pct exceedances	61	10	0	(+)

Since 1950:

	No. stns	+ trends	- trends	region
1-day total	61	28	2	++
2-day total	61	28	2	++
Avg on non-zero days	61	11	1	++
Variability	61	16	0	(+)
Annual max	61	8	0	(+)
Number of 99 th pct exceedances	61	19	0	++

Since 1980:

	No. stns	+ trends	- trends	region
1-day total	61	6	1	(+)
2-day total	61	6	1	(+)
Avg on non-zero days	61	8	2	(+)
Variability	61	5	1	(+)
Annual max	61	0	1	(+)
Number of 99 th pct exceedances	61	5	3	(-)

NORTHEAST

Since 1888:

	No. stns	+ trends	- trends	region
1-day total	27	12	0	++
2-day total	27	12	0	++
Avg on non-zero days	27	7	1	(+)
Variability	27	4	0	(+)
Annual max	27	3	0	(-)
Number of 99 th pct exceedances	27	5	0	(+)

Since 1950:

	No. stns	+ trends	- trends	region
1-day total	27	12	0	++
2-day total	27	12	0	++
Avg on non-zero days	27	7	1	(+)
Variability	27	4	0	(+)
Annual max	27	3	0	(-)
Number of 99 th pct exceedances	27	5	0	++

Since 1980:

	No. stns	+ trends	- trends	region
1-day total	27	10	1	++
2-day total	27	10	1	++
Avg on non-zero days	27	6	0	(+)
Variability	27	2	0	(+)
Annual max	27	1	0	(+)
Number of 99 th pct exceedances	27	1	1	++

Summary

Evaluating the NCA5 claim of an increase in heavy precipitation since 1950 across the CONUS, we find that we cannot reproduce it as stated. There is no evidence of an upward trend in rainfall or heavy precipitation (annual maximum or 99th percentile exceedances) in the Pacific Coast region and only mixed evidence in the Midwest and Northeast. The pattern is strongest in the Southeast. In all cases, however, only a few stations in each region exhibit statistically significant trends. Also in all cases, including the Southeast, the trends weaken in the post-1980 interval which suggests the trend is not tied to greenhouse gases. Furthermore, in no case is there a significant upward trend in the annual maximum or 99th percentile exceedances over the whole sample period back to the late 1800s.

References

Christy, John (2025) Precipitation Data Archive for 61 Midwest Stations.

https://www.nsstc.uah.edu/data/ushcn_irc/US_MidW_61stn_dly_ppt_1893_2024_250704.xlsx

Climate Working Group (2025) Impacts of Carbon Dioxide Emissions on the U.S. Climate. Washington DC: Department of Energy, May 27, 2025.

McKittrick, R., and J.R. Christy (2019). Assessing changes in US regional precipitation on multiple time scales. *Journal of Hydrology*, 578, 124074. <https://doi.org/10.1016/j.jhydrol.2019.124074>

McKittrick, R. and J.R. Christy (2025), "Data and Code for CWG2025 Report", Mendeley Data, V1, doi: 10.17632/by76s7rxfb.1

Vogelsang, T.J. and Franses, P. H. (2005) Testing for Common Deterministic Trend Slopes, *Journal of Econometrics* 126 <https://doi.org/10.1016/j.jeconom.2004.02.004>.

From: John Christy [climateman60@gmail.com]
Sent: 7/13/2025 1:03:50 AM
To: Judith Curry [curry.judith@gmail.com]
CC: Ross McKittrick [ross.mckittrick@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Steve Koonin [steven.koonin@gmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

Judy

Correct. Three of those five are simply links to datasets. Only two are publications one for Ross and me, and one for Steve.

As I suggested earlier, we could make reference to NCA review problems and put the 1.4 section as an appendix or link.

John C.

John Christy
Director, Earth System Science Center
Professor, Atmos and Earth Science
Alabama State Climatologist
The University of Alabama in Huntsville
climateman60@gmail.com

On Jul 12, 2025, at 7:11 PM, Judith Curry <curry.judith@gmail.com> wrote:

back from my trip, catching up. Look at NCA5 references, there are 17 total, and 5 are Christy/McKittrick/Koonin.

I will go through the changes to CWG, then get back to NCA5

On Fri, Jul 11, 2025 at 12:49 PM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

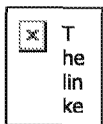
- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they

were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

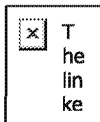
- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Saturday, July 12, 2025 8:12 PM
To: Ross McKittrick
Cc: John Christy; Roy W. Spencer; Steven Koonin; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

back from my trip, catching up. Look at NCA5 references, there are 17 total, and 5 are Christy/McKittrick/Koonin.

I will go through the changes to CWG, then get back to NCA5

On Fri, Jul 11, 2025 at 12:49 PM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We

would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it

seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin [steven.koonin@gmail.com]
Sent: 7/12/2025 10:18:22 PM
To: 'Ross McKittrick' [ross.mckittrick@gmail.com]; 'John Christy' [climateman60@gmail.com]
CC: 'judith curry' [curry.judith@gmail.com]; 'Roy W. Spencer' [roywspencer@hotmail.com]; 'Travis Fisher' [travis.scott.fisher@gmail.com]; 'Josh Loucks' [loucksj14@gmail.com]; 'Seth Cohen' [seth.cohen@hq.doe.gov]
Subject: RE: NCA5 progress
Attachments: ~WRD0003.jpg

Ross- Can you send around the most recent version of the NCA5 review. I can't seem to identify it in the emails and would like to go through it again in the next few days.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy <climateman60@gmail.com>
Cc: judith curry <curry.judith@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, I suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but it's too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What I'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are Christy, McKittrick, Koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this.

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25.

John if you can you send me the spreadsheet you used I'll propose a rewrite.

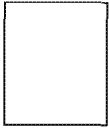
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick <ross.mckitrick@gmail.com>
Sent: Friday, July 11, 2025 3:49 PM
To: John Christy
Cc: judith curry; Roy W. Spencer; Steven Koonin; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

John and I only appear in Section 4.1 as part of challenging the reproducibility of the NCA5 Key Message regarding precipitation. 2 of our 3 citations in the reference list are data archives which are there for transparency purposes.

On Fri, Jul 11, 2025 at 2:53 PM John Christy <climateman60@gmail.com> wrote:
Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: John Christy <climateman60@gmail.com>
Sent: Friday, July 11, 2025 2:54 PM
To: judith curry
Cc: Ross McKittrick; Roy W. Spencer; Steven Koonin; Travis Fisher; Josh Loucks; Seth Cohen
Subject: Re: NCA5 progress

Judy

I must be missing something. Our papers directly address the issues espoused by NCA5. We offer all the data and methods. Why should our work be suppressed?

John C.

Sent from my iPhone

On Jul 11, 2025, at 1:16 PM, judith curry <curry.judith@gmail.com> wrote:

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:
Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



To help protect
your privacy,
Microsoft Office
prevented
automatic
download of this
picture from the
Internet.

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick [ross.mckittrick@gmail.com]
Sent: 7/11/2025 6:50:12 PM
To: Steven Koonin [steven.koonin@gmail.com]
CC: judith curry [curry.judith@gmail.com]; John Christy [climateman60@gmail.com]; Roy W. Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]; Seth Cohen [seth.cohen@hq.doe.gov]
Subject: Re: NCA5 progress

There's a lot of that about, even in Canada

<https://nationalpost.com/news/politics/canadians-drastically-downgrade-climate-as-a-priority-poll-finds-as-economic-concerns-escalate>

On Fri, Jul 11, 2025 at 2:47 PM Steven Koonin <steven.koonin@gmail.com> wrote:

Interesting data on one component of our audience:

<https://x.com/townhallcom/status/1943307220705223127>

SEK

From: judith curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 2:16 PM
To: John Christy <climateman60@gmail.com>
Cc: Ross McKittrick <ross.mckittrick@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

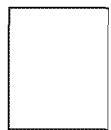
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Friday, July 11, 2025 2:48 PM
To: 'judith curry'; 'John Christy'
Cc: 'Ross McKittrick'; 'Roy W. Spencer'; 'Travis Fisher'; 'Josh Loucks'; 'Seth Cohen'
Subject: RE: NCA5 progress
Attachments: ~WRD4011.jpg

Interesting data on one component of our audience:

<https://x.com/townhallcom/status/1943307220705223127>

SEK

From: judith curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 2:16 PM
To: John Christy <climateman60@gmail.com>
Cc: Ross McKittrick <ross.mckittrick@gmail.com>; Roy W. Spencer <roywspencer@hotmail.com>; Steven Koonin <steven.koonin@gmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Josh Loucks <loucksj14@gmail.com>; Seth Cohen <seth.cohen@hq.doe.gov>
Subject: Re: NCA5 progress

We need to think about our audience who we want to reach and influence. We don't want this to be another salvo in the climate wars. But to rise above it and be hyper objective.

Sent from my iPhone

On Jul 11, 2025, at 10:07 AM, John Christy <climateman60@gmail.com> wrote:

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG

adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckitrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

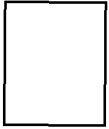
2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: John Christy <climateman60@gmail.com>
Sent: Friday, July 11, 2025 1:07 PM
To: Judith Curry
Cc: Ross McKittrick; Roy W. Spencer; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

Judy

... Christy, McKittrick and Koonin ... you could look at it this way: we're the only ones willing to stick our heads up when the bullets are flying and endure protracted battles with editors and reviewers. Publishing in journals in this "climate" takes its toll, and most folks with an objective side just give up. We would love to cite other authors who do these NCA5-type analyses using the proper methods ... there just aren't many out there. As you know, there's no profit (or funding) in fighting the climate establishment. However, please, let us know if you see something we've missed.

John C.

On Fri, Jul 11, 2025 at 11:21 AM Judith Curry <curry.judith@gmail.com> wrote:

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Roy Spencer <roywspencer@hotmail.com>
Sent: Friday, July 11, 2025 12:58 PM
To: Ross McKittrick; Judith Curry; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: RE: NCA5 progress

Regarding the TX floods, it was a perfect storm from a human vulnerability point of view. 4th of July holiday with lots of campers, flood was mainly when people were asleep. Remnants of a TS and little steering flow to spread the rain around. Not record setting river levels for stations with 50+ years of record, poor cell service, and i read phones had been taken away from the young campers. NOAA weather radio is a pain in the butt... BUT.. it should be required for the camp office. I'm sure I'm missing a few points....

Sent from my Verizon, Samsung Galaxy smartphone

----- Original message -----

From: Ross McKittrick <ross.mckittrick@gmail.com>
Date: 7/11/25 10:19 AM (GMT-06:00)
To: Judith Curry <curry.judith@gmail.com>, "Roy W. Spencer" <roywspencer@hotmail.com>, John Christy <climateman60@gmail.com>, Steven Koonin <steven.koonin@gmail.com>, Travis Fisher <travis.scott.fisher@gmail.com>, Josh Loucks <loucksj14@gmail.com>, "Cohen, Seth" <seth.cohen@hq.doe.gov>
Subject: NCA5 progress

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

From: Ross McKittrick <ross.mckitrick@gmail.com>
Sent: Friday, July 11, 2025 12:47 PM
To: Judith Curry
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

My read of the NCA5 chapter is that there are non-specific mentions of flood risk but there's more focus on drought and declining precipitation. No actionable information.

On Fri, Jul 11, 2025 at 12:45 PM Judith Curry <curry.judith@gmail.com> wrote:
will do, but wont get to it until sunday (road trip to las vegas to pick up the new puppy)

One angle for TX is to look at the South Central region chapter from NCA5 and see if the mention that region is prone to heavy floods

On Fri, Jul 11, 2025 at 9:41 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:
Judy could you generate a text iteration so we can see in context the way you'd like these to be handled? No need to include lengthy strike out text, just use track changes.

On Fri, Jul 11, 2025 at 12:32 PM Judith Curry <curry.judith@gmail.com> wrote:
Re TX floods and disasters, read this, good news

<https://www.mikesmithenterprisesblog.com/2025/07/breaking-news-thank-you-dr-neil-jacobs.html>

Addressing the disaster issue is outside of the scope of USGCRP, if we mention TX in NCA5 review at all it should be about 1 sentence. There is a place for it in CWG if we could do an attribution analysis, but premature

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckitrick@gmail.com> wrote:
We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 12:45 PM
To: Ross McKitrick
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

will do, but wont get to it until sunday (road trip to las vegas to pick up the new puppy)

One angle for TX is to look at the South Central region chapter from NCA5 and see if the mention that region is prone to heavy floods

On Fri, Jul 11, 2025 at 9:41 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

Judy could you generate a text iteration so we can see in context the way you'd like these to be handled? No need to include lengthy strike out text, just use track changes.

On Fri, Jul 11, 2025 at 12:32 PM Judith Curry <curry.judith@gmail.com> wrote:

Re TX floods and disasters, read this, good news

<https://www.mikesmithenterprisesblog.com/2025/07/breaking-news-thank-you-dr-neil-jacobs.html>

Addressing the disaster issue is outside of the scope of USGCRP, if we mention TX in NCA5 review at all it should be about 1 sentence. There is a place for it in CWG if we could do an attribution analysis, but premature

On Fri, Jul 11, 2025 at 8:19 AM Ross McKitrick <ross.mckitrick@gmail.com> wrote:

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

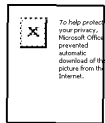
- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Friday, July 11, 2025 12:42 PM
To: Judith Curry
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

Judy could you generate a text iteration so we can see in context the way you'd like these to be handled? No need to include lengthy strike out text, just use track changes.

On Fri, Jul 11, 2025 at 12:32 PM Judith Curry <curry.judith@gmail.com> wrote:
Re TX floods and disasters, read this, good news

<https://www.mikesmithenterprisesblog.com/2025/07/breaking-news-thank-you-dr-neil-jacobs.html>

Addressing the disaster issue is outside of the scope of USGCRP, if we mention TX in NCA5 review at all it should be about 1 sentence. There is a place for it in CWG if we could do an attribution analysis, but premature

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



To help protect
your privacy,
Outlook often
prevents
automatic
download of the
picture from the
Internet.

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 12:32 PM
To: Ross McKittrick
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

Re TX floods and disasters, read this, good news

<https://www.mikesmithenterprisesblog.com/2025/07/breaking-news-thank-you-dr-neil-jacobs.html>

Addressing the disaster issue is outside of the scope of USGCRP, if we mention TX in NCA5 review at all it should be about 1 sentence. There is a place for it in CWG if we could do an attribution analysis, but premature

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012

<http://www.cfclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 12:28 PM
To: Ross McKittrick
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

We presume to critique the NCA5 (not the NCA4) because:

1. We were asked to critique the report because of concerns about objectivity/bias
2. New Gold Standard EO

We don't need to justify the review by digging up a convoluted example from NCA4

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

--



To help protect
your privacy,
Microsoft Office
prevented
automatic
download of this
picture from the
Internet.

Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry <curry.judith@gmail.com>
Sent: Friday, July 11, 2025 12:22 PM
To: Ross McKittrick
Cc: Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: Re: NCA5 progress

Re 1.4 and TX, i suggest we incorporate these points briefly in existing chapters. The content of 1.4 is already covered in CWG, apart from the convoluted peer review issue. CWG adequately covers temperature extremes, we don't need more of that in NCA beyond length of temperature records. Re TX, might fit best in CWG attribution, but its too early for that I think.

In 8.3 Recommendations for NCA5, we should recommend an increased focus on predicting individual extreme events and communicating the forecast, rather than attributing them to whatever.

What i'm struggling with in the NCA5 critique is that if you read it without an author list, you would figure the authors are christy, mckittrick, koonin. This should be a relatively short, high-level critique and IMO we need to depersonalize this

On Fri, Jul 11, 2025 at 8:19 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Ross McKittrick <ross.mckitrick@gmail.com>
Sent: Friday, July 11, 2025 11:19 AM
To: Judith Curry; Roy W. Spencer; John Christy; Steven Koonin; Travis Fisher; Josh Loucks; Cohen, Seth
Subject: NCA5 progress

We seem to have stalled on iterating the NCA5 report. Here are the issues on the table:

1. Whether to drop Section 1.4

- my thinking is I like the idea of the section because it justifies why we would presume to critique a report that has already gone through 11 government agencies and a National Academies review. At the same time I think it could be shortened and made more effective with a different version of the Figure from CWG25. John if you can you send me the spreadsheet you used I'll propose a rewrite.

2. Do we include a case study of the Texas floods?

- What I like about that section is that it is a vivid example of how a document that could have provided useful info for disaster planners not only failed to do so, but it would have misdirected resources if they were to have relied on it. But it's easy to have 20/20 hindsight. Presumably somewhere in the US at this moment there are several potential weather-related hazards poised to cause death and destruction later this year, and the local authorities are not ready for them. We need to explain what it would look like for an NCA to be a useful resource in that context. What say ye all?

3. Tidying

- I find the LLM critiques to be somewhat helpful in anticipating possible lines of attack, but they are overly algorithmic and often end up saying "they make a valid point but that's not the consensus so it's probably wrong." And it seems to have hallucinated about things we didn't even say. Still, it points to the need to guard against snark.

From: Judith Curry <curry.judith@gmail.com>
Sent: Friday, August 15, 2025 10:35 AM
To: Steve Koonin; John Christy; Roy Spencer; Ross McKittrick
Subject: Pielke Jr

Excellent and very relevant article today

https://rogerpielkejr.substack.com/p/too-big-to-fail?utm_source=post-email-title&publication_id=119454&post_id=171008167&utm_campaign=email-post-title&isFreemail=false&r=16uxd&triedRedirect=true&utm_medium=email

--



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin [steven.koonin@gmail.com]
Sent: 7/1/2025 9:28:06 PM
To: 'Judith Curry' [curry.judith@gmail.com]; 'Roy W. Spencer' [roywspencer@hotmail.com]; 'John Christy' [climateman60@gmail.com]; 'Ross McKittrick' [ross.mckittrick@gmail.com]; 'Travis Fisher' [travis.scott.fisher@gmail.com]; 'Josh Loucks' [loucksj14@gmail.com]; 'Cohen, Seth' [seth.cohen@hq.doe.gov]
Subject: FW: Ruse or Reform? Scientists Debate Trump's 'Gold Standard Science' Order
Attachments: image002.png

FYI: Science Policy News from AIP
BULLETIN

July 1, 2025

Ruse or Reform? Scientists Debate Trump's 'Gold Standard Science' Order

Jacob Taylor

Scientists are mulling whether the effort has merit or is simply an attempt to undermine independent science.

 The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

White House staff secretary Will Scharf, center left, describes an executive order on "Gold Standard Science" to President Donald Trump during a signing ceremony. The president did not comment on the order during the ceremony, which focused on four separate executive orders dedicated to nuclear energy. Molly Riley / The White House

A trio of contrasting op-eds published recently in the journal *Science* illustrates the scientific community's internal debate over the state of scientific integrity and whether to be receptive to the Trump administration's research policy initiatives.

The White House claims the public has lost trust in science due to the previous administration misusing science to justify certain policies and the scientific community failing to address the "reproducibility crisis." A centerpiece of the administration's plan is the "Restoring Gold Standard Science" executive order issued in May, which requires agencies to revise their scientific integrity policies to align with certain principles, such as ensuring scientific studies are reproducible and protecting employees who offer "alternative scientific opinions." It also establishes an enforcement process overseen by appointees designated by each agency head.

Various scientists have raised concerns about the enforcement mechanism, with professors David Michaels and Wendy Wagner writing in *Science* that the order "officially empowers political appointees to override conclusions and interpretations of government scientists, threaten their professional autonomy, and undermine the scientific capacity of research and regulatory agencies."

In a dueling op-ed, White House Office of Science and Technology Policy Director Michael Kratsios defends the order as necessary to reinforce established principles of good conduct and accuses critics of being "more concerned with their preferred policy outcomes than with the procedures that reinforce scientific rigor and excellence."

Kratsios does not directly respond to criticisms of the enforcement mechanism but states, "It is the responsibility of those appointed to represent the people to help direct and coordinate the taxpayer-supported research enterprise in the national interest." He also states that while science ought to be kept free of "partisan politics," there is also a need to preserve "democratic government from the excessive influence of the scientific establishment."

Kratsios concludes by encouraging the scientific community to "take this government-led effort at self-reform and review how it too can support the highest standards of scientific integrity."

The op-ed came one day after Kratsios sent instructions to agency heads detailing how they should incorporate the executive order's principles into their research activities. The instructions do not prescribe specific actions but do provide more detailed explanations of the tenets originally described in the executive order. Agencies are to publish their implementation plans by Aug. 22.

Holden Thorp, editor-in-chief of Science, published his own op-ed the same day as Kratsios' that sympathizes with critics of the order but encourages scientists "to support science and hold it accountable at the same time" and to reject the "false choice that only one or the other is possible."

Thorp writes that, "It is logical to worry that the EO will be misused by the administration given the other disastrous decisions made about science so far, especially the cuts to funding and the barriers to recruiting international students."

However, he also argues that the order and larger efforts by the Trump administration to weaken the scientific enterprise have been enabled by pervasive "sluggishness and defensiveness" in response to criticism.

Thorp suggests that the scientific community should "reaffirm its values" but do so on its own terms, "irrespective of actions from a government entity in the United States or elsewhere."

Thorp's op-ed details examples of journals being slow to retract papers, prominent scientists clumsily deflecting accusations of misconduct, and the closing of ranks within specific fields in response to credible criticisms of popular research.

He argues that these individual examples are not necessarily reflective of the larger scientific community, but that the distinction is moot if the public believes they are.

"Although science is driven by data, politics and public opinion are shaped by anecdotes and storytelling. Thus, pointing out that many of these incidents are the result of a small number of actors does nothing to change the political narrative," Thorp writes.

"The defensiveness of investigators and institutions in responding to problems severely heightens the suspicion," he adds. "Rather than filing lawsuits and hiding behind carefully crafted statements, the scientific community should be engaging in a conversation about problems and potential solutions."

The White House highlighted that same passage in a press release as an example of "exactly why President Trump signed his Restoring Gold Standard Science executive order."

Thorp criticized the administration just days later in a LinkedIn post for violating the very principles laid out in the executive order by citing fake studies in a CDC report on vaccines, which Thorp called "disgraceful" and "hypocritical." He also acknowledged the challenges in holding the administration to account, writing that "calling it out is important for documenting all of this for posterity, but it's not a political strategy that will stop this charade."

Have a news tip for us? Contact the author via email at jataylor@aip.org.

More From FYI

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

The Week of
June 30, 2025
JUN 30, 2025

- NSF booted from its HQ
- DOD, Commerce detail major proposed science cuts
- \$150M for DOE AI R&D added to Senate reconciliation bill

The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

Spectrum
Auctions
Raise
Concerns for
Scientists
JUN 25, 2025

Some astronomers and atmospheric scientists want to see protections for relevant spectrum bands in

reconciliation
proposals.

DOE

Secretary

Defends Cuts

to National

Labs while

Suggesting

Future Boost

JUN 20, 2025

Democrats and
Republicans
alike raised
concerns about
the Trump
administration's
proposed cuts
to lab research
and staff at a
recent hearing.

 The linked image cannot be displayed. The file may have been moved, renamed, or deleted. Verify that the link points to the correct file and location.

Sign Up For FYI

Did someone forward you this email? Click **this link** to sign up and get FYI delivered straight to your inbox!



This message is sent to you because you signed up for one of our newsletters. To manage your AIP email preferences and newsletter subscriptions (**add or remove**), please **click here**. Or to automatically unsubscribe from all AIP emails, **click here**.

As a 501(c)(3) non-profit, AIP is a federation that advances the success of our Member Societies and an institute that engages in research and analysis to empower positive change in the physical sciences. The mission of AIP (American Institute of Physics) is to

advance, promote, and serve the physical sciences for the benefit
of humanity.

© 2025 American Institute of Physics.

AIP, 1 Physics Ellipse, College Park, MD 20740-3841
301.209.3100 - newsletters@aipcomm.org

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

Chapter 10 RISK AND ITS ASSESSMENT

“[I]n itself, nothing is a risk, there are no risks in reality. Inversely, anything can be a risk; it all depends on how one frames the danger, considers the event.” – French philosopher François Ewald¹

The concept of risk is an outgrowth of concerns about coping with dangers. For most of human history, the assessment and management of risk occurred informally by trial and error. More than 2400 years ago, Athenians articulated the capacity of assessing risk before making decisions.² However, as the influence and scale of technology expanded, it became evident that society needed to assess risks proactively. Science has increasingly allowed us to recognize and measure more subtle hazards, which has been coupled with a general decreasing tolerance for risk in modern industrialized society.³

Risk assessment and management as a scientific field is only about 30–40 years old. There are many different perspectives on risk, and some of these perspectives represent substantially different frameworks. However, there is broad agreement on the basic ideas and principles of risk understanding, assessment, communication and management.⁴

Risk may have positive or negative outcomes or may simply result in uncertainty. Fire and accidents only have negative outcomes, and they are often referred to as hazard risks. Taking a risk can also result in a positive outcome. Risk can also be related to uncertainty of outcome. However, most applications of risk analysis focus on adverse outcomes.

Climate change presents a challenge to risk assessment that is uniquely complex, uncertain and ambiguous. This chapter provides perspectives on risk and its perception, how risk is

characterized and analyzed, and why climate change is such a challenging problem for risk analysis.

10.1 Risk and Perception

“You are so convinced that you believe only what you believe that you believe, that you remain utterly blind to what you *really* believe without believing you believe it.”

– American writer Orson Scott Card⁵

Climate risk is generally regarded as hazard risk, although there are potential positive outcomes as well. The related terms “threat” and “hazard” refer to something that could cause harm, with the possibility of trouble, danger or ruin.⁶ The hazard may be something that is impending and imminent, or something that is likely, or merely possible. A forecasted extreme weather event is an imminent, impending hazard. For climate change supported by scenarios from global climate models or expert assessments, *likely* is the descriptor in IPCC parlance. Possibility is used for military threats and threats to cybersecurity, based on creatively imagined scenarios.

Risk has often been characterized as some type of statistical expected value – the product of the likelihood of occurrence and the impact if it occurs. However, such a characterization is appropriate only for simple or tame problems. Broader definitions of risk integrate specified consequences of an event or actions, a measure of uncertainty associated with the consequences, and the strength of the background knowledge that supports the assessment.⁷

The IPCC defines climate change risk through the dynamic association of the three core elements of risk: hazard, exposure and vulnerability. Hazard captures the frequency and intensity of extreme weather and climate events or slowly emerging change such as sea level rise. Exposure

refers to the elements of populace, infrastructures and social welfare at risk. Vulnerability refers to the exposures' potential to suffer as well as its ability to manage, withstand and rebound.⁸

The main concerns surrounding the consequences of manmade global warming are described below:⁹

- 1) Risk of death, injury, ill health or disrupted livelihoods in low lying coastal zones and small island developing states due to storm surges, coastal flooding and sea level rise;
- 2) Risk of severe ill health and disrupted livelihoods for large urban populations due to inland flooding;
- 3) System risks due to extreme weather events leading to breakdown of infrastructure networks and critical services such as electricity, water supply and health and emergency services;
- 4) Risk of mortality and morbidity during periods of extreme heat, particularly for vulnerable urban populations and those working outdoors in urban or rural areas;
- 5) Risk of food insecurity and the breakdown of food systems linked to warming drought flooding and precipitation variability and extremes, particularly for poorer populations in urban and rural settings;
- 6) Risk of loss of rural livelihoods and income due to insufficient access to drinking and irrigation water and reduced agricultural productivity, particularly for farmers and pastoralists with minimal capital in semi-arid regions;
- 7) Risk of loss of marine and coastal ecosystems, biodiversity and ecosystem goods, functions and services they provide for coastal livelihoods, especially for fishing communities in the tropics and the Arctic; and

- 8) Risk of loss of terrestrial and inland water ecosystems, biodiversity and the ecosystem goods, functions and services they provide for livelihoods.

As evidenced from this list, risks from human-caused climate change are convoluted with natural weather and climate variability, and are dominated by societal vulnerabilities in context of developing states and poorer populations.

10.1.1 Risk perceptions

“Something frightening poses a perceived risk. Something dangerous poses a real risk.” – Swedish physician Hans Rosling et al.¹⁰

Apart from the objective facts about a risk, the social sciences find that our interpretation of those facts is ultimately subjective. Risk science makes a clear distinction between professional judgments about risk versus the public perception of risk. Risk perception is a person’s subjective judgement or appraisal of risk, which can involve social, cultural and psychological factors.

No matter how strongly we feel about our perceptions of risk, we often get risk wrong. People worry about some things more than the evidence warrants (e.g. vaccines, nuclear radiation, genetically modified food), and less about other threats than the evidence warrants (e.g., obesity, using mobile phones while driving). This gap in risk perception produces social policies that protect us more from what we are afraid of than from what actually threatens us the most. Understanding the psychology of risk perception is important for rationally managing the risks that arise when our subjective risk perception system gets things dangerously wrong.¹¹

The Psychometric Paradigm research of psychologist Paul Slovic and collaborators describes a suite of psychological characteristics that make risks feel more or less frightening, relative to the actual facts^{12 13 14}

- natural versus manmade risks
- risks that are detectable versus undetectable (without special instrumentation)
- controllable versus uncontrollable risks
- voluntary versus imposed risks
- risks with benefits versus uncompensated risks
- known risks versus vague risks
- risks central to people's everyday lives versus uncommon risks
- future versus immediate risks
- equitable versus asymmetric distribution of risks.

In each of these pairs, the first risk type is generally preferred to the second risk type. For example, risks that are common, self-controlled and voluntary, such as driving, generate the least public apprehension. Risks that are rare and imposed that lack potential upside, like terrorism, invoke the most dread.¹⁵

Communicators hoping to spur action on climate change emphasize the manmade aspects of climate change, the unfair burden of risks on undeveloped countries and poor people, and the more immediate risks of severe weather events. The recent occurrence of infrequent events (e.g. a hurricane or flood) produces disparate perceptions of the risk of low probability events, that translate into perceptions of overall climate change risk.

The cultural theory of risk proposes that individual views on risk are filtered through cultural world views about how society should operate.¹⁶ People tend to relate their position on the environmental risk spectrum with how they perceive nature. Risk seekers view nature as robust, while risk avoiders see nature as fragile. In between can be found risk regulators that see a robust nature with bounds, leaving those who are indifferent to risk who view nature as unpredictable and view risk truly as just chance.¹⁷

Even if the initial harm is small, the social risk may be greatly amplified by the collective response or irrational behaviors of individuals. The response to climate risk, driven by alarmism and “extinction” rhetoric, has arguably crossed the threshold to actually increasing the social risk associated with climate change.

10.1.2 Risk characterization

“We must see these things objectively, as we do a tree; and understand that they exist whether we like them or not. We must not try and turn them into something different by the mere exercise of our own minds, as if we were witches.” – English writer and theologian G.K. Chesterton¹⁸

The concept of hazard risk captures both the threat contribution and vulnerability to the threat. Risk can be split into two main components: i) occurrence of the triggering events and associated uncertainties; and ii) consequences, given the events, and the associated uncertainties.

The concept of resilience is closely related to vulnerability. Resilience is defined as the ability of the system to maintain functionality and recover, given that one or more triggering events occur.

The ability—or lack of ability—of impacted systems to maintain performance and recover from the event will determine the consequences of the event.

An important element of characterizing risk is evaluating the strength of knowledge (Section 9.3). Concerns about strength of the knowledge base are raised by people questioning aspects of the IPCC's assessment that are used to infer climate risk. The IPCC approach is based on judgement of the available evidence and agreement among experts. More sophisticated knowledge characterizations for risk management include:¹⁹

- (i) the degree to which the assumptions made are reasonable/realistic based on our background knowledge – growing concern about the focus on implausible emissions scenarios RCP8.5/SSP5-8.5 (Section 7.1)
- (ii) the degree to which data/information exists and are reliable and relevant – the historical and paleo data base is inadequate for a complete characterization of natural climate variability on multi-decadal to millennial time scales
- (iii) the degree to which there is disagreement among experts (including those from different environments) – attempts to suppress disagreement and alternative perspectives among experts (Section 2.4)
- (iv) the degree to which the phenomena involved are understood and accurate models exist – concerns about the fidelity and utility of climate models (Chapter 6)
- (v) the degree to which the knowledge has been thoroughly examined with respect to unknown knowns – neglect of the unknown knowns associated with natural climate variability (Section 8.2).

Accepting the IPCC's assessments as the best available knowledge base is not inconsistent with acknowledging significant weaknesses in the knowledge base in context of climate risk analysis.

There are various types of risk, independent of the nature of the triggering event or the consequence. In 1921, economist Frank Knight articulated a definition of risk that distinguished risk from uncertainty.²⁰ Knightian risk implies that robust probability information is available about future outcomes, allowing risks to be treated in terms of probability and effects. Knightian risk underlies the technocratic, decisionistic and economic models of risk assessment and management.²¹ Similarly, mathematician Benoit Mandelbrodt differentiates between "mild" and "wild" risk.²² Systems that are predictable, have large quantities of sample cases to explore and that conform to normal style distributions would be considered mild. In contrast, random behavior, unusual distributions and largely unpredictable systems fall into the wild realm.²³ The danger lies in making the assumption a risk is mild when it is indeed wild.

Knightian-based, or mild, risk assessment and management is suited to simple, or tame, problems (Section 3.4). For simple risks, the cause for the risk is well known, the negative consequences are obvious, and randomness is low. The risk consequences are reversible and are well understood in terms of the science and regulation. Simple risks are recurrent and not affected by ongoing or expected major changes; hence, assessing the risks in statistical terms is meaningful. Examples include car accidents and regularly recurring weather hazards – hazards that insurance companies have traditionally covered.

Simple risks are characterized by low complexity, low uncertainty and low ambiguity. However, the most worrisome risks are not associated with simple problems. Wild risks are associated with high uncertainty and even ignorance. Complexity gives rise to systemic risk. Related to the

term “mess” that was introduced in Section 3.4, “ambiguity” means that there are different legitimate viewpoints from which to evaluate whether there are, or could be, adverse effects and whether these risks are tolerable. Ambiguity results from divergent and contested perspectives on the justification, severity or wider meanings associated with a perceived threat.²⁴

Some example types of risk that are not simple:²⁵

- Combination of low probability with high extent of damage. This includes technological risks associated with nuclear power plants or dams.
- Disaster potential is high and relatively well known, but little is known about causal factors. Earthquakes and volcanoes are examples.
- Human interventions in the environment that cause wide-ranging, persistent and irreversible changes, which are discovered after the interventions. Examples include large infrastructure projects such as dams and river engineering.
- There is a considerable delay between the triggering event and the occurrence of damage. Fossil fuel emissions are an example.

Risk conceptions can also be usefully categorized based on future predictability – the extent to which historical records are useful in assessing the risk of a future outcome.²⁶ When there is a clear causal relationship, the past can be a very good predictor of the future. However when uncertainty prevails the past is not a good indicator of the future and unprecedented outcomes can occur.²⁷

The concept of emerging risk is gaining increasing attention. Emerging risk is related to an activity when the background knowledge is weak but contains indications/justified beliefs that a new type of event could occur in the future and potentially have severe consequences to

something humans value. The weak background knowledge results in difficulty specifying consequences and as well in specifying scenarios.²⁸ Intergenerational impacts are a concern with emerging risks. Global warming is clearly an emerging risk. An important consideration when thinking about emerging risks is the speed at which they can become significant, which is referred to as the risk velocity.

Climate change risk includes elements of both incremental risk and emergency risk. Incremental risk displays creeping characteristics and the “fat tail” effect. Since changes take place rather slowly, the adverse consequences take a long time to emerge. Some climate impacts are expected to accumulate and worsen over time and across space. The slow creep of sea level rise is an example of incremental risk. A more complex example is the risk of long-term water shortage in Africa, which reduces food production over time and aggravates malnutrition and other health problems, leading to migration and regional violent conflicts. The potential impacts and long-term consequences can easily be underestimated in the early stage. Once incremental risks cross a critical point, they are difficult to manage – this relates to the so-called climate “tipping points” (Section 1.3.2).

Emergency risks are associated with extreme weather events; technically these are weather risks and not climate risks, even if global warming could be shown to incrementally worsen the weather hazard. Weather risk can become climate risk if global warming causes the event to exceed a vulnerability threshold that otherwise wouldn’t have been exceeded by the weather event. Attempts are also made to assess incremental costs/damages associated with extreme weather events. Such assessments are very challenging to make against the background of natural weather and climate variability.

10.1.3 Direct versus systemic risk

“A dike ten thousand feet long begins its crumbling with holes made by ants” –

Chinese philosopher (Zhou Dynasty) Han Fei Tzu²⁹

Direct risks from a hazard arise from a direct impact arising from the driver or event. Examples of direct risk from climate change include: heat stress to people, crop production failures, damage from unusual river flooding, sea level rise for coastal cities. Direct risks can be non-linear – while average conditions may change gradually, the risks can increase more rapidly if critical vulnerability thresholds are exceeded.

The risks of climate change to human interests depend not only on the direct impacts from changes in the physical climate, but also on the response of complex human systems such as the global economy, food markets, and the system of international security. In complex systems, small changes can sometimes lead to large divergences in future state. Systemic risks are characterized by a high degree of complexity, uncertainty, and ambiguity.³⁰ Many problems categorized as a “wicked mess” (Section 3.4) can also be categorized as systemic risks.

The greatest risks associated with climate change are systemic. Systemic risks may arise from the interaction of the climate with complex human systems such as global food markets, governance arrangements and international security. Systemic risks are much less straightforward to assess than direct risks. Systemic risks may be initiated by local stressor such as an extreme weather event, which can have impacts extending far beyond the impacted location. An example of national and international security systemic risk is triggered by regional drought, resulting in migration and displacement, food price spikes, civil unrest, state failure, terrorism, humanitarian crises, and transboundary water disputes.³¹

Hazard events that previously might have caused localized impacts can now have cascading and even global impacts. Consider the severe, widespread flooding in Thailand during 2011. The flooding was triggered by the landfall of a tropical storm, spreading through much of Thailand along the Mekong and Chao Phraya River basins. The systemic nature of this event arose from flooding of the industrial estates and production plants around Bangkok.³²

Apart from cascading effects on Thailand's economy, this local flood ended up having systemic impacts across countries, regions and economic sectors, affecting supply chains as far away as Japan and the United States. Key manufacturing sectors such as the automobile, electronics and electrical appliances industries experienced abrupt declines in production and exports. The disruption caused a global shortage of hard disk drives, which lasted throughout 2012.³³ Components manufactured in Thailand were essential for products finalized in other countries, causing disruption or collapse of the entire production chains.

10.2 Risk Assessment

“When knowledge is uncertain, experts should avoid pressures to simplify their advice.” – science and technology policy researcher Andy Stirling³⁴

Risk assessment is the systematic process of identifying risk sources, threats, hazards and opportunities; understanding how these can materialize/occur; identifying specific trigger events and event sequences, and what their consequences could be; representing and expressing uncertainties; and determining the significance of the risk.³⁵ The role of risk assessment is to support understanding, communication and decision-making processes.

Traditional risk assessment has been based on historic data—assessing probabilities of severity, frequency and impact based on experience from past events. In times of global change, this approach is no longer adequate to capture future risks. Scenarios of future climate and extreme events are generated by models and by storyline approaches (Chapters 7, 8, 9).

Apart from the likelihood and impacts of the risk, values and ancillary issues that contribute to risk perception should be integrated into the risk assessment. Further, risk evaluation requires assessment of risk(s)–benefit(s) and risk–risk trade-offs.³⁶ Risks need to be assessed in context of all of the relevant dimensions that matter to the affected populations.³⁷ A broad assessment of the risk provides a knowledge base so that decision makers have better guidance on how to select measures for managing the risk.

Narrow risk assessments of well-understood phenomena with ample data might be uncontested. However for contentious issues, the outcome of a risk assessment may be strongly influenced by the many inherent value judgments (often unknowingly) made by the analyst. Scientific studies have trouble resolving differences when the value assumption process is murky. Wise policymakers are likely to dismiss overly certain assessments, properly recognizing their biases or naivete. Trust is built via an open dialog around value assumptions, reducing the concerns of hidden agendas.³⁸

10.2.1 Acceptable versus intolerable risk

~~“We must contemplate some extremely unpleasant possibilities, just because we want to avoid them.”³⁹—American nuclear strategist Albert Wohlstetter~~

NEW QUOTE “Time heals nothing. It only brings other issues and tissues, and takes what is incurable or unacceptable out of the center of our attention.”

— **Ana Claudia Antunes, author of *The Tao of Physical and Spiritual***

An essential aim of risk assessment is to qualify the risks in terms of the social acceptability and tolerability. The “traffic light model” identifies three categories for risks: normal/acceptable risks, intermediate/tolerable risks and intolerable risks.⁴⁰ Normal risks are characterized by low complexity, little statistical uncertainty and low catastrophic potential (Knightian or mild risk), and are well understood by science and easily managed by regulatory mechanisms.⁴¹

Activities are tolerable if they are considered as worth pursuing for the associated benefits. For tolerable risks, efforts for risk reduction or coping are welcomed provided that the benefits of the activities are not lost. Burning fossil fuels has historically been considered a tolerable risk.⁴² Genuinely intolerable risks include existential threats—such as portrayed by the earth-impacting comet in the movie *Don’t Look Up*—or “ruin” problems.^{43 44}

How to draw the lines between “acceptable”, “tolerable” and “intolerable” is one of the most controversial tasks in the risk governance process for complex risks. Ambiguity results from divergent and contested perspectives on the justification, severity or wider meanings associated with a perceived threat.⁴⁵ Climate change risks have been characterized as acceptable, tolerable and intolerable by different individuals and constituencies – clearly an ambiguous situation.

Using the example of extreme weather risks, fairly routine destruction by hurricanes in certain coastal regions is generally categorized as tolerable, with some locations working to decrease vulnerability over time by improving building codes and engineering the coast to minimize the impact of storm surge. By contrast, a rare but extreme event such as Superstorm Sandy striking

New York City was judged to be associated with intolerable risk and a large adaptation deficit, given the large population and property value that was impacted and high vulnerability of the infrastructure.

For complex problems, often neither the risks nor the benefits can be clearly identified or agreed upon. Multiple dimensions and values need to be considered. A heavily contested assessment of the (in)tolerability or acceptability of risks is highly relevant input to the decision-making process, in context of the ambiguity of the risk.

10.2.2 Assessment of systemic risks

~~“We live on an island surrounded by a sea of ignorance. As our island of knowledge grows, so does the shore of our ignorance.”⁴⁶—John Wheeler~~

**NEW QUOTE “it is not a calculated risk if you haven’t calculated it.”
— Naved Abdali, author of Investor LINK**

In most problems of systemic risk, there are numerous ambiguous and unknown risks. Due to the complexity of systemic risk and the limited understanding of the risk propagation paths, there are substantial uncertainties in terms of the cascading effect of the systemic risk on the influence domain.

Key characteristics of systemic risk are broadly categorized under five themes: the scale of the system, the relationship of the elements within a system, the level of system understanding, the transboundary effects and the outcomes of systemic risk.⁴⁷

An important tool in characterizing systemic risk is forensic analysis of previous disasters. Forensic analysis combines retrospective longitudinal analysis, disaster scenarios, comparative case analysis and meta-analysis research, along with enhanced involvement of development stakeholders.⁴⁸ Forensic analysis can help better understand how and why disasters occur and their complex linkages with natural, infrastructure and societal systems.⁴⁹

Recognizing the depth of uncertainty about the future state of complex systems, assessment of systemic risk relies on the tools of scenarios and wargaming to help us think about what might happen. A key challenge for systemic risk assessment is to identify key linkages and the potential for critical transitions, in context of how systemic risks cascade through interdependent networks in both physical and social systems.⁵⁰ Complex challenges like pandemics or climate change should be assessed in the global context of megatrends such as urbanization, growing populations, demographic changes, environmental degradation, and technological change.

In risks that go beyond ordinary dimensions, such as COVID-19 and climate change, the reliability of any risk assessment is low, uncertainty is high, catastrophic potential can possibly reach alarming dimensions and systematic knowledge about the distribution of consequences is missing. Such risks may generate global, irreversible damages, which may accumulate during a long time or mobilize or frighten the population; or alternatively, the risks may turn out to be relatively benign. An unequivocal conclusion about the degree of validity associated with the scientific risk evaluation isn't feasible. For such problems, risk assessments are most effectively used as a tool used to represent and describe knowledge and lack of knowledge, and to formulate narratives of possible danger.

10.3 Climate Change Risk

“I have long argued climate messaging needs to be about here and now, kitchen table issues ... not 8 decades from now or way in the Arctic” – meteorologist Marshall Shepherd⁵¹

Many public organizations, ranging from the United Nations to local municipalities, have conducted risk assessments of climate change impacts. There is also a growing trend for private companies with responsibility to shareholders to conduct climate risk assessments. Virtually all of these climate risk assessments are based on assessment reports from the IPCC.

Cumulative risks at national and global levels are linked to the principle of avoiding dangerous climate change as defined by the UNFCCC, which is tied to assumed risk thresholds of +1.5 °C and +2 °C global warming above pre-industrial level. The most recent IPCC reports have formulated a risk-based approach for understanding the risk factors that lead to regional/local climate change impacts, and the role of adaptation initiatives in managing these risk factors. The importance of regional climate change risk assessments is recognized politically through the UNFCCC in context of Warsaw International Mechanism for Loss and Damage and the Sendai Framework for Disaster Risk Reduction under the auspices of the UN Office for Disaster Risk Reduction.^{52 53}

Thus far, government-sponsored climate change assessments have primarily been rooted in communicating a scientific consensus around anticipated changes in the physical climate system, along with some impacts that are generally implied by those climate changes. The assessments have not characterized or analyzed specific societal risks due to climate change, including socio-environmental causes of vulnerability related to climate hazards.⁵⁴

Climate risk assessments for industry sectors and infrastructure sectors reveal challenges from interconnectivities, interdependencies across value chains, and the impacts of policy and regulations.⁵⁵ International dimensions include mechanisms such as price, material flows, movement of people and political stability, with specific emphasis on food security and geopolitical risks.⁵⁶

The complexity, uncertainty and ambiguity associated with climate risk point to a number of challenges and frontier issues for assessing the risks associated with climate change in a policy-based context. These include the issue of dealing with systemic risks, critical knowledge gaps regarding Earth system processes, and the complexity of societal responses – which could collectively lead to extremely challenging outcomes. Much of the uncertainty in climate change assessments is irreducible; this uncertainty should be treated as a source of actionable knowledge through its influence on the viability of different decision strategies. While the UNFCCC has framed climate risk in terms of dangers, risk assessment should evaluate both positive and negative aspects of change to support a balanced appraisal of alternative decision options. Other issues relate to risk assessment processes themselves, such as managing uncertainty and clarifying the hidden values assumptions of the risk analysts.⁵⁷

This section presents the case that it is time for a shift in the objectives and implementation of climate change assessments – from making what amounts to a general case for ‘action’ regarding eliminating fossil fuel emissions, to characterizing specific regional risks and vulnerabilities in a manner that helps people develop, select, carry out, and monitor actions that ultimately have greater benefits than costs.⁵⁸

10.3.1 How we have mischaracterized climate risk

“The global climate change debate has gone badly wrong. Many mainstream environmentalists are arguing for the wrong actions and for the wrong reasons, and so long as they continue to do so they put all our futures in jeopardy.” – philosopher Thomas Wells⁵⁹

The communication and handling of the climate change risk is strongly dependent on the way risk is conceptualized and described.

In the early 1980’s, the United Nations Environmental Program (UNEP) became bullish on the idea that fossil fuels would produce dangerous climate change. The prospect of eliminating fossil fuels was congruent with UNEP’s broader interests in environmental quality and world governance. At Villach, Austria, in 1985 at the beginning of the climate treaty movement, the policy movement to eliminate fossil fuels became detached from its moorings in the science – the rhetoric of precaution argued that we should act anyway to eliminate fossil fuels, just in case.^{60 61} This perspective became codified by the 1992 UN Framework Convention on Climate Change (UNFCCC) Treaty in 1992, the Kyoto Protocol in 1997 and the 2015 Paris Climate Agreement.

The fundamental presupposition of the UNFCCC climate treaties and agreements is that human-caused climate change associated with fossil fuel emissions is dangerous – natural climate variability and most other human impacts on climate were essentially ignored. There was an implicit assumption that warming was dangerous, ignoring any potential benefits. In attempting to build political will for the international agreements, the adverse impacts of fossil-fuel driven climate change were exaggerated – more frequent and intense severe weather/climate events, sea

level rise and many adverse ecosystem, health, economic and geopolitical impacts, with all of their complex causes, were conflated with fossil-fuel driven warming (Section 1.1).

The torquing of climate science and the manufacture of a consensus around human-caused climate change (Chapter 2) not only oversimplified the scientific and social challenges, but led to the adoption of a “predict then act” strategy to manage and control the climate. This strategy is based on the belief that climate change is a simple or tame problem, with science trumping all practical questions and conflicting values and purposes.

One of the biggest problems associated with climate change assessments is that there is no simple way to articulate danger associated with a warmer climate (Section 1.3) To circumvent this challenge, the problem of climate change has been reduced to one of CO₂ emissions, with the elimination of human-caused emissions as the primary strategy for dealing with the problem. This strategy ignores the fact that there is no precise link between CO₂ emissions and global mean surface temperature, owing to uncertainties in climate sensitivity to CO₂ (Section 7.2) and the poorly constrained natural variations of the climate system. An alternative approach focused on a specified “dangerous” surface temperature threshold.⁶² This approach also requires accurate accounting and projections of natural climate variability from solar variability, volcanic eruptions, and multi-decadal to millennial scale ocean variations (Section 8.2). An additional complication is that the temperature targets of 1.5 and 2.0 °C do not have a sound scientific basis as thresholds for danger (Section 1.3).

Further, the temperature-based approach of specifying a dangerous threshold ignores nonlinearities in the climate system. Climatic “tipping points” (Section 1.3), which have been described as “real critical thresholds,” do not all occur at the same temperature threshold. If

unknown climate tipping points exist that are associated with natural climate processes, there can be no certainty that the risk of climate catastrophe would be eliminated even if emissions fell to zero.⁶³

The end result of the way in which the IPCC/UNFCCC have characterized the climate change problem is that we are focused on meeting emissions targets that are arguably unachievable in the near term, rather than on obtaining a deeper understanding of the climate system and the broader causes of vulnerabilities of human and natural systems. Further, the slow incremental risks of warming have been mischaracterized as urgent, leading to rapid implementation of policies that are not only costly and suboptimal, but also arguably reduce societal resilience to weather and climate variability, whatever their causes.

The politics of international climate governance has produced systematic biases in the kinds of expertise and evidence that are deemed appropriate for consideration.⁶⁴ The UNFCCC and IPCC have characterized climate change as an environmental and economic problem, and geoscientists and economists have dominated the assessment and policy making process.

However, the issues with increasing CO₂ and warming are social, not environmental. The Earth has undergone geological periods of higher temperatures and atmospheric CO₂ concentrations, during which life thrived. Characterization of climate change as an environmental problem has downplayed the cultural and political dimensions of the issue.⁶⁵ In fact, many social scientists have argued that climate change is a values problem, and that the disciplinary constrictions imposed by the IPCC and UNFCCC have neglected many important insights arising from a wide range of expert and unaccredited sources.⁶⁶

Clarifying the multitude of values in play would help illuminate the ambiguity surrounding interpretations of climate risk. However, characterizing climate change as a values problem can also lead into blind alleys. Many environmentalists have moralized the climate change problem as a simple, righteous values choice: Are you for the planet or against it?⁶⁷ This moralizing neglects to understand that people engage in activities which are of value to them that happen to emit carbon as a byproduct.⁶⁸ Further, this narrow moralizing systematically excludes important ethical values, such as improving the lives of the billion people presently living in unacceptable poverty or protecting other aspects of the environment.⁶⁹

The end result is that after 30 years of the UNFCCC/IPCC, we remain fixated on the minutiae of greenhouse gas emissions levels and the abstract and impossible problem of constraining atmospheric CO₂ concentration – while ignoring natural climate variability and drastically simplifying the human impacts and responses. As long as the current situation prevails, the IPCC’s assessments of anthropogenic climate change and the UNFCCC recommendations for action will remain seriously inadequate.

This fixation on global CO₂ levels alone as the problem and solution has led Norwegian risk scientist Terje Aven to conclude:

“The current thinking and approaches guiding this conceptualization and description have been shown to lack scientific rigour, the consequence being that climate change risk and uncertainties are poorly presented. The climate change field needs to strengthen its risk science basis, to improve the current situation.”⁷⁰

The UNFCCC is promoting a solution to an exceedingly complex, uncertain and ambiguous problem, without reference to wider ethical issues, and political and practical feasibility. We

have neglected to truly understand the problem and systematically and broadly evaluate the feasible policy space.

10.3.2 Reframing the assessment of climate risk

“[A] problem well put is half solved.” – American philosopher John Dewey⁷¹

Climate risks are exceedingly complex and scientific forecasts are subject to large uncertainties. As a result, there is deep uncertainty within climate change risk assessments. In the face of this deep uncertainty, a conventional predict-then-act approach is paralyzed by limits to prediction and lack of clarity regarding the potential consequences. Estimating the severity of the consequences based only on the potential economic losses ignores a series of impacts that are not easily quantified. In summary, we are far from a thorough assessment of full climate risk that would allow for efficient and targeted policies and support rational risk taking.⁷²

With this context, the risks from climate change need to be reframed more broadly, in context of advances in risk science.⁷³

There is an emerging literature on characterizing systemic risks from climate change. Systemic risks induced by climate change have three basic characteristics: 1) the wide scope of impacts, affecting a wide range of natural, economic and social systems; 2) the long duration of impacts; and 3) cumulativeness of these impacts that grow over time.⁷⁴

Assessment of systemic risk must account for the complexity of the climate system and the integrated effects on politics, the economy, society, culture, and the environment. Both emergency risks associated with extreme weather events and the slow creep of incremental risks have characteristics of systemic risk. Interaction of climate with a variety of processes of global

environmental change (both natural and human systems) represents an increased need to identify and characterize multiple stressors and their interactions across different scales.⁷⁵

How does a categorization of systemic risk actually help with the practical assessment of climate risk? Is such a diagnosis similar to a categorization of a problem as a wicked mess (Section 3.4), which may lead people to throw up their hands and shrug their shoulders? It is sometimes argued that a full assessment of the risks of climate change would be counterproductive, because the risks may be so large and the solutions so difficult that people will be overwhelmed with a feeling of helplessness, and will look the other way. However, rather than stymieing a solution, such categorizations help identify situations where simplistic solutions won't work and suggest paths that may lead to partial solutions and reductions in vulnerability.

There are a number of strategies that can be helpful for assessing systemic risks. These include portraying the full range of extreme future scenarios (global and regional), including extreme weather and climate events and worst-case scenarios (Chapters 8, 9). These scenarios can be used to drive narratives of danger and to stress test social and infrastructure systems. It is important to differentiate between acute impacts associated with extreme weather events versus incremental risks that develop over time, based on different latent periods and manifestations. Forensic analysis of previous disasters and their complex effects can provide important insights in developing scenarios of systemic risks.

Judgments of intolerable risks from climate change relate to mistakenly conflating the slow creep of global warming (an emerging risk) with consequences from extreme weather and climate events (emergency risks) and concerns about inequitable risk exposure to poorer populations. Removing the risks associated with the most extreme weather and climate events from the

consequences of global warming diminishes the perceived urgency for reducing fossil fuel emissions. The poorest populations would benefit far more from access to grid electricity and help in reducing vulnerability from extreme weather events, than from reductions to the amount of CO₂ in the atmosphere. Bjorn Lomborg, False Alarm

The uncertainties and complexity of the forces driving the social, biological, and physical dimensions of climate change ensure that we will most likely be surprised by the outcomes. However, there are several features of the climate problem that suggest that climate change related risks will increase in the future. These factors are:⁷⁶

- There is a substantial time lag between the emission of greenhouse gases and the related impacts, and the link to many impacts is not yet fully understood.
- Science is unable to predict long-term impacts accurately enough to provide a strong signpost for action.
- There is large heterogeneity in historical, current and expected future emissions among countries and sectors, and there is no single culprit.
- Variance and heterogeneity of climate related hazards and benefits are large, and winners and losers may change over time.
- There is large heterogeneity in vulnerability among countries, sectors and ecosystems.

The question of intergenerational equity is of special importance for emerging risks, owing to the lag between the emissions of greenhouse gases and the expected occurrence of the damage. There is no simple way to decide what duty of care we owe to future generations, but the IPCC's

socioeconomic pathways for the 21st century all have the world being better off by 2100, even under the most extreme emissions scenarios.

A key to securing meaningful action to reduce climate change risk is to clearly separate the incremental, emerging risks associated with long-term changes in average conditions—which can be addressed to some extent in the long term by reducing greenhouse gas emissions—from the emergency risks associated with extreme weather and climate events, which need to be addressed in both the present and future climate. Any assessment of climate risk needs to approach these two kinds of risk differently, depending on the nature of the decisions it aims to inform.

Once the incremental risks are separated from the emergency risks, the perception of urgency in reducing emissions is diminished. It becomes far more important to develop strategies for managing atmospheric greenhouse gases in a way that supports a transition that does not have adverse impact on security, the economy, industry and agriculture. The challenges for risk assessment are then to identify transition risks associated with proposed solutions to mitigate the rising atmospheric CO₂ content.

At this point, assessing the transition risks of eliminating fossil fuels is arguably more important than attempting to refine our assessments of the deeply uncertain incremental risks associated with fossil fuel emissions. Consequences of the transition are associated with a fairly solid knowledge base, leading many people to be more concerned about transition risks than they are about the more uncertain risks from climate change itself that are associated with a far weaker knowledge base.^{77 78 79}

Assessments of emergency risk associated with extreme weather and climate events generally focus on event type, sectoral impacts or regional assessments. Too many of these assessments are seemingly intended to build political will for eliminating fossil fuel emissions rather than conducting a serious assessment of emergency risk including systemic aspects.

A laudable example of weather emergency risk assessment relates to the ARkStorm scenario described in Section 9.4.2, related to extreme winter flooding in central California.⁸⁰ The state of California's ShakeOut Earthquake Scenario to support preparedness for a major earthquake demonstrated how postulating a hypothetical but plausible catastrophe provides a basis for better examining the interdependencies in social structure and infrastructure and expose choke-points and vulnerabilities.⁸¹ The ARkStorm risk assessment project engaged emergency planners, businesses, universities, government agencies, and others. Following a thorough development of the storm scenario and its direct impacts on inundation and landslides, they assessed secondary impacts on highways, electricity systems, wastewater treatment, water supply, dams, levees, telecommunications, agriculture, buildings, evacuation and sheltering strategies, business interruption, truck transport, and environmental and health issues associated with hazardous materials. The ARkStorm scenario and risk assessment informed community decision-making and is helping communities increase their resilience to severe California winter storms.⁸²

In assessing emergency risk from extreme weather/climate events, there are some key principles to follow:⁸³

1. Emergency risk from extreme weather/climate events is dominated by plausible worst-case events. Looking at extreme event data back to 1950, and calculating return periods, isn't useful here. Global climate models are of no direct use for

extreme event scenarios. Of the three extreme events selected in Section 9.4, the Florida hurricane scenario was based on data from 1935, the ARkStorm scenario was based on data from 1861/62, and the south Asian monsoon failure was based on data from 1756-1768 – the latter two cases were informed not only by historical records but also by paleoclimate reconstructions.

2. Consider all events, even if their probability of occurrence in a particular location is low. The low probability/high impact events, provided that the events are judged to be plausible or have occurred in the past, are associated with the greatest risks. Nevertheless, the cumulative impact of weaker events can also be significant.
3. Be holistic. Account for all relevant factors, as far as possible – including human behavior and the complex interactions between different parts of a system. Evaluate both direct and systemic risks across the relevant time and space windows appropriate to the decision process.
4. Assess the current risk from weather/climate extremes, based on historical extreme events and today's societal vulnerabilities. Additional scenarios can be created with incremental effects from global warming.

The seemingly overwhelming challenge of climate risk assessment and the associated political conflicts becomes more tractable by separating the incremental, emerging risk from the emergency risk associated with weather/climate extremes. By regionalizing risk governance, the management approach does not depend on an impossible global agreement for a dubious “perfect” solution that requires moral and political coercion. The regional approach offers a feasible pathway that respects the existing interests and values of the human beings concerned.

This approach works within our existing political institutions (no need for a global government) and offers transparent arguments for action within our present valuational framework, rather than requiring us all to assume a new and narrow set of values.⁸⁴

10.3.3 Climate change versus COVID-19 risk

“There is no power for change greater than a community discovering what it cares about” – writer Margaret Wheatley⁸⁵

The outbreak of the COVID-19 pandemic in the end of 2019 has generated or contributed to a series of interconnected financial, societal, and political crises on a global scale. This has triggered comparative studies of systemic risks of pandemics and climate change, which share many commonalities despite obvious differences.⁸⁶

Both pandemic and climate risks are systemic, in that their impacts propagate rapidly across an interconnected world. Both COVID-19 and climate change risks are nonstationary, with past probabilities and distributions of occurrences rapidly shifting and proving to be inadequate for future projections. Both risks are nonlinear, in that their socioeconomic impact grows disproportionately and even catastrophically once certain thresholds are breached (such as hospital capacity to treat pandemic patients). Both COVID-19 and climate change are risk multipliers, that highlight and exacerbate hitherto untested vulnerabilities inherent in the financial, energy, food and healthcare systems and the overall economy. Both risks affect disproportionately the world’s most vulnerable populations.⁸⁷

However, the timescales of both the occurrence and the resolution of pandemics and climate hazards are different. Pandemic risk is measured in weeks, months, and years; climate risk is

measured in decades and centuries. A pandemic presents imminent, discrete, and directly discernable dangers. By contrast, the risks from climate change, are gradual, cumulative, and distributed, manifesting themselves over time and in spatially heterogeneous way.⁸⁸ The primary difference between the pandemic and climate hazards is that the salience of the threat and perceived urgency of dealing with it.⁸⁹

¹ Graham Burchell and François Ewald, “Insurance and Risk,” in *The Foucault Effect: Studies in Governmentality ; with Two Lectures and an Interview with Michel Foucault* (Chicago, IL: Univ. of Chicago Press, 1991).

² Joshua P. Nudell, “An Ancient Greek Approach to Risk and the Lessons It Can Offer the Modern World,” *The Conversation*, February 22, 2021, <https://theconversation.com/an-ancient-greek-approach-to-risk-and-the-lessons-it-can-offer-the-modern-world-154139>.

³ Daniel J. Rozell, “Values in Risk Assessment,” in *Dangerous Science: Science Policy and Risk Analysis for Scientists and Engineers* (London, UK: Ubiquity Press, 2020), 29-56.

⁴ “Resources,” Society for Risk Analysis, accessed May 24, 2022, <https://www.sra.org/resources/>.

⁵ Orson Scott Card, *Shadow of the Hegemon* (New York, NY: Tor, 2009).

⁶ Ortwin Renn, *Risk Governance Coping with Uncertainty in a Complex World* (London, UK: Routledge, 2008).

⁷ Terje Aven, “Risk Assessment and Risk Management: Review of Recent Advances on Their Foundation,” *European Journal of Operational Research* 253, no. 1 (August 16, 2016): 1-13, <https://doi.org/10.1016/j.ejor.2015.12.023>.

⁸ Christopher B. Field, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation: Special Report of the Intergovernmental Panel on Climate Change* (Cambridge, UK: Cambridge University Press, 2012).

⁹ Brian C. O'Neill et al., “IPCC Reasons for Concern Regarding Climate Change Risks,” *Nature Climate Change* 7, no. 1 (January 4, 2017): 28-37, <https://doi.org/10.1038/nclimate3179>.

¹⁰ Hans Rosling et al., *Factfulness: Ten Reasons We're Wrong about the World - and Why Things Are Better than You Think* (New York, NY: Flatiron Books, 2018).

¹¹ David Ropeik, *How Risky Is It Really?: Why Our Fears Don't Always Match the Facts* (New York, NY: McGraw-Hill, 2010).

¹² Paul Slovic, “Perception of Risk,” *Science* 236, no. 4799 (April 17, 1987): 280-285, <https://doi.org/10.1126/science.3563507>.

¹³ Carl Cranor, “A Plea for a Rich Conception of Risks,” in *The Ethics of Technological Risk*, ed. L. Asveld and S. Roeser (London, UK: Routledge, 2008).

¹⁴ Nicolas Espinoza, “Incommensurability: The Failure to Compare Risks,” in *The Ethics of Technological Risk*, ed. L. Asveld and S. Roeser (London, UK: Routledge, 2008).

¹⁵ Daniel J. Rozell, *Dangerous Science* (London, UK: Ubiquity Press, 2020).

¹⁶ Mary Douglas and Aaron Wildavsky, *Risk and Culture an Essay on the Selection of Technological and Environmental Dangers* (Berkeley, CA: Univ. of California Press, 1983).

¹⁷ Elizabeth Fisher and Judith S. Jones, *Implementing the Precautionary Principle: Perspectives and Prospects* (Cheltenham, UK: Edward Elgar Publishing Limited, 2006).

¹⁸ G K Chesterton, “The Fulfillment of Wishes,” Chesterton Digital Library, November 22, 1913, <https://library.chesterton.org/the-fulfillment-of-wishes-40578/>.

¹⁹ Terje Aven, “Improving Risk Characterisations in Practical Situations by Highlighting Knowledge Aspects, with Applications to Risk Matrices,” *Reliability Engineering & System Safety* 167 (November 2017): 42-48, <https://doi.org/10.1016/j.ress.2017.05.006>.

²⁰ Frank H. Knight, *Risk, Uncertainty and Profit* (Boston, MA: Houghton, 1921).

²¹ Ortwin Renn et al., “Coping with Complexity, Uncertainty and Ambiguity in Risk Governance: A Synthesis,” *AMBIO* 40, no. 2 (February 3, 2011): 231-246, <https://doi.org/10.1007/s13280-010-0134-0>.

- ²² Benoit B. Mandelbrot and Richard L. Hudson, *The (Mis)Behaviour of Markets: A Fractal View of Risk, Ruin, and Reward* (London, UK: Profile Books, 2010).
- ²³ Ibid.
- ²⁴ Andy Stirling, "Risk, Uncertainty and Precaution: Some Instrumental Implications from the Social Sciences," *Negotiating Environmental Change*, 2003, <https://doi.org/10.4337/9781843765653.00008>.
- ²⁵ Ortwin Renn and Andreas Klinke, "Systemic Risks: A New Challenge for Risk Management," *EMBO Reports* 5, no. S1 (November 2004), <https://doi.org/10.1038/sj.embor.7400227>.
- ²⁶ Emmy Wassénus and Beatrice I. Crona, "Adapting Risk Assessments for a Complex Future," *One Earth* 5, no. 1 (January 21, 2022): pp. 35-43, <https://doi.org/10.1016/j.oneear.2021.12.004>.
- ²⁷ Ibid.
- ²⁸ R. Flage and T. Aven, "Emerging Risk – Conceptual Definition and a Relation to Black Swan Type of Events," *Reliability Engineering & System Safety* 144 (December 2015): 61-67, <https://doi.org/10.1016/j.ress.2015.07.008>.
- ²⁹ Han Fei Tzu and W. K. Liao, *The Complete Works of Han Fei Tzu: A Classic of Chinese Political Science* (London, UK: Arthur Probsthain, 1959).
- ³⁰ Ortwin Renn and Andreas Klinke, "Systemic Risks."
- ³¹ David King et al., "Climate Change: A Risk Assessment" (Cambridge, UK, 2015).
- ³² Aekapol Chongvilaivan, "Thailand's 2011 Flooding: Its Impact on Direct Exports, and Disruption of Global Supply Chains," *ARTNeT Working Paper Series* 113 (2012).
- ³³ Ibid.
- ³⁴ Andy Stirling, "Keep It Complex," *Nature* 468, no. 7327 (December 23, 2010): 1029-1031, <https://doi.org/10.1038/4681029a>.
- ³⁵ Terje Aven, "Risk Assessment and Risk Management."
- ³⁶ Ortwin Renn et al., "Coping with Complexity."
- ³⁷ Ibid.
- ³⁸ Daniel J. Rozell, *Dangerous Science*.
- ³⁹ Albert Wohlstetter, "No Highway to High Purpose," Rand Corporation, 1960, <https://doi.org/10.7249/p2084>.
- ⁴⁰ Ortwin Renn and Andreas Klinke, "Systemic Risks."
- ⁴¹ Ibid.
- ⁴² Alex Epstein, *The Moral Case for Fossil Fuels* (New York, NY: Portfolio/Penguin, 2015).
- ⁴³ "Don't Look Up," Don't Look Up (Netflix, December 24, 2021), <https://www.netflix.com/title/81252357>.
- ⁴⁴ Nassim Nicholas Taleb et al., "The Precautionary Principle (with Application to the Genetic Modification of Organisms)," October 2014, <https://doi.org/https://doi.org/10.48550/arxiv.1410.5787>.
- ⁴⁵ Andy Stirling, "Keep It Complex."
- ⁴⁶ John Horgan, "The New Challenges," *Scientific American* 267, no. 6 (December 1992): 16-23.
- ⁴⁷ J Sillmann et al., "ISC-UNDRR-RISK KAN Briefing Note on Systemic Risk" (Paris, FR: International Science Council, 2022).
- ⁴⁸ Anthony Oliver-Smith et al., "Forensic Investigations of Disasters (FORIN): a Conceptual Framework and Guide to Research," *Integrated Research on Disaster Risk*, 2016.
- ⁴⁹ Arabella Fraser et al., "Developing Frameworks to Understand Disaster Causation: From Forensic Disaster Investigation to Risk Root Cause Analysis," *Journal of Extreme Events* 03, no. 02 (2016): 1650008, <https://doi.org/10.1142/s2345737616500081>.
- ⁵⁰ W. Neil Adger et al., "Advances in Risk Assessment for Climate Change Adaptation Policy," *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 376, no. 2121 (2018): 20180106, <https://doi.org/10.1098/rsta.2018.0106>.
- ⁵¹ Marshall Shepherd @DrShepherd2013, "I have long argued climate messaging needs to be about here and now, kitchen table issues...not 8 decades from now or way in the Arctic." Twitter, February 12, 2022, <https://mobile.twitter.com/DrShepherd2013/status/1492506606583656450>.
- ⁵² "Warsaw International Mechanism for Loss and Damage Associated with Climate Change Impacts," United Nations Framework Convention on Climate Change, accessed May 26, 2022, <https://unfccc.int/topics/adaptation-and-resilience/workstreams/loss-and-damage/warsaw-international-mechanism>.
- ⁵³ "Sendai Framework for Disaster Risk Reduction 2015-2030," World Health Organization, 2015, <https://www.who.int/publications/m/item/sendai-framework-for-disaster-risk-reduction-2015-2030>.
- ⁵⁴ C P Weaver et al., "Reframing Climate Change Assessments around Risk: Recommendations for the US National Climate Assessment," *Environmental Research Letters* 12, no. 8 (2017): 080201, <https://doi.org/10.1088/1748-9326/aa7494>.

-
- ⁵⁵ Swenja Surminski et al., “Assessing Climate Risks across Different Business Sectors and Industries: An Investigation of Methodological Challenges at National Scale for the UK,” *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 376, no. 2121 (April 30, 2018): 20170307, <https://doi.org/10.1098/rsta.2017.0307>.
- ⁵⁶ Andy J. Challinor et al., “Transmission of Climate Risks across Sectors and Borders,” *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 376, no. 2121 (April 30, 2018): 20170301, <https://doi.org/10.1098/rsta.2017.0301>.
- ⁵⁷ Ibid.
- ⁵⁸ C P Weaver et al., “Reframing Climate Change Assessments.”
- ⁵⁹ Thomas Rodham Wells, “Debating Climate Change: The Need for Economic Reasoning,” The Philosopher's Beard, September 10, 2012, <http://www.philosophersbeard.org/2012/09/debating-climate-change-need-for.html>.
- ⁶⁰ “The Origins of the IPCC: How the World Woke up to Climate Change,” International Science Council, March 10, 2018, <https://council.science/current/blog/the-origins-of-the-ipcc-how-the-world-woke-up-to-climate-change/>.
- ⁶¹ Bernie Lewin, *Searching for the Catastrophe Signal: The Origins of the Intergovernmental Panel on Climate Change* (Melbourne, AU: The Global Warming Policy Foundation, 2017).
- ⁶² Adam Lucas, “Risking the Earth Part 1: Reassessing Dangerous Anthropogenic Interference and Climate Risk in IPCC Processes,” *Climate Risk Management* 31 (2021): 100257, <https://doi.org/10.1016/j.crm.2020.100257>.
- ⁶³ Ibid.
- ⁶⁴ Adam Lucas, “Risking the Earth Part 2: Power Politics and Structural Reform of the IPCC and UNFCCC,” *Climate Risk Management* 31 (2021): 100260, <https://doi.org/10.1016/j.crm.2020.100260>.
- ⁶⁵ Mike Hulme and Martin Mahony, “Climate Change: What Do We Know about the IPCC?,” *Progress in Physical Geography: Earth and Environment* 34, no. 5 (June 18, 2010): 705-718, <https://doi.org/10.1177/0309133310373719>.
- ⁶⁶ Adam Lucas, “Risking the Earth Part 2.”
- ⁶⁷ Thomas Rodham Wells, “Debating Climate Change.”
- ⁶⁸ Alex Epstein, *The Moral Case for Fossil Fuels*.
- ⁶⁹ Rafaela Hillerbrand and Michael Ghil, “Anthropogenic Climate Change: Scientific Uncertainties and Moral Dilemmas,” *Physica D: Nonlinear Phenomena* 237, no. 14-17 (August 15, 2008): 2132-2138, <https://doi.org/10.1016/j.physd.2008.02.015>.
- ⁷⁰ Terje Aven, “Climate Change Risk – What Is It and How Should It Be Expressed?,” *Journal of Risk Research* 23, no. 11 (November 9, 2019): 1387-1404, <https://doi.org/10.1080/13669877.2019.1687578>.
- ⁷¹ John Dewey, *Logic: The Theory of Inquiry* (New York, NY: Holt, Reinhart and Winston, 1938).
- ⁷² Terje Aven, “Climate Change Risk.”
- ⁷³ Terje Aven, “Risk Assessment and Risk Management.”
- ⁷⁴ Hui-Min LI et al., “Understanding Systemic Risk Induced by Climate Change,” *Advances in Climate Change Research*, June 2021, <https://doi.org/10.1016/j.accre.2021.05.006>.
- ⁷⁵ Ibid.
- ⁷⁶ Michael Obersteiner et al., “Managing Climate Risk” (Laxenburg, AT: International Institute for Applied Systems Analysis, 2001).
- ⁷⁷ Mark Carney, “Breaking the Tragedy of the Horizon – Climate Change and Financial Stability,” Bank for International Settlements, September 29, 2015, <https://www.bis.org/review/r151009a.pdf>.
- ⁷⁸ Christa Clapp et al., “Shades of Climate Risk. Categorizing Climate Risk for Investors,” CICERO Research Archive (CICERO Center for International Climate and Environmental Research - Oslo, 2017), <https://pub.cicero.oslo.no/cicero-xmlui/handle/11250/2430660>.
- ⁷⁹ Matthew Scott et al., “The Bank's Response to Climate Change,” Bank of England, June 16, 2017, <https://www.bankofengland.co.uk/quarterly-bulletin/2017/q2/the-banks-response-to-climate-change>.
- ⁸⁰ Keith Porter et al., *Overview of the Arkstorm Scenario* (Reston, VA: Dept. of the Interior. U.S. Geological Survey, 2011).
- ⁸¹ “The Great California Shakeout,” Great ShakeOut Earthquake Drills, 2008, <https://www.shakeout.org/california/scenario/>.
- ⁸² Keith Porter et al., *Overview of the Arkstorm Scenario*.
- ⁸³ David King et al., “Climate Change: A Risk Assessment.”
- ⁸⁴ Thomas Rodham Wells, “Debating Climate Change.”
- ⁸⁵ Margaret J. Wheatley, *Turning to One Another: Simple Conversations to Restore Hope to the Future* (San Francisco, CA: Berrett-Koehler, 2002).

⁸⁶ Dickon Pinner et al., “Addressing Climate Change in a Post-Pandemic World,” McKinsey & Company (McKinsey & Company, April 7, 2020), <https://www.mckinsey.com/business-functions/sustainability/our-insights/addressing-climate-change-in-a-post-pandemic-world>.

⁸⁷ Ibid.

⁸⁸ Ibid.

⁸⁹ Geoffrey Saville, “The Wicked Problems of Pandemics and Climate Change,” Willis Towers Watson, June 3, 2020, <https://www.wtwco.com/en-US/Insights/2020/05/the-wicked-problems-of-pandemics-and-climate-change>.

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

From: John Christy <climateman60@gmail.com>
Sent: Thursday, May 29, 2025 10:21 PM
To: Judith Curry
Cc: Steven Koonin; Ross McKittrick; Roy Spencer; Travis Fisher; Josh Loucks
Subject: Re: NCA5: Scientific assessment or social engineering?

Regarding NCA6:

We could go back to the original congressional language and inform the Administration what type of document is actually required and give them an outline. I think NCA6 should be short.

John C.

Sent from my iPhone

On May 29, 2025, at 5:07 PM, Judith Curry <curry.judith@gmail.com> wrote:

Your thoughts on our group making a pre-emptive unofficial recommendation on what should be in the next NCA and how the process should proceed? or is there some infrastructure on this that is already underway (i'm out of the loop). Some pre-emptive common sense might be useful

On Thu, May 29, 2025 at 8:20 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I had a first-hand exposure to the NASEM process when I chaired their Divisional Committee for Engineering and Physical Sciences (DEPSCOM) for six years. We oversaw the commissioning, execution, and publication of (I'd guess) more than 100 reports during that time. They were all quite well done, but none of them concerned climate science.

NASEM on climate was an entirely different matter. I got stonewalled when I tried to complain about it to the management. And friends who were on climate-related studies have some horror stories to tell.

I'd hope that if we do a critique of NCA5, we'll also comment on the NASEM role. They really dropped the ball.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Thursday, May 29, 2025 10:53 AM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: John Christy <climateman60@gmail.com>; Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

Without even reading the NASEM report I assume it's useless. The problem is they draw experts from govt agencies and universities. That crowd knows that the NCA serves a partisan purpose so they'll pull their punches to prevent giving fodder to the enemies of the movement.

The data show universities are about 95/5 dems/gop and not only that, but among the dems the party identification is "strong" versus mostly "weak" or "leans" among gop. So draw a random sample from academia (ensuring a "wide range" of views blah blah blah) and you end up with left and further left. Up until recently we had to go along with the illusion that expert panels can be relied upon to provide balanced scientific advice but the obvious bias of the IPCC and NCA, among others (CDC, WHO etc) have killed that expectation. They let themselves be colonized by the left and now they've lost any claim on public trust.

RPJr posted this data from a recent UChicago survey

<image001.png>

Almost 50% of republicans (and 30% of independents) now view ivy league universities not just as useless but as their enemies. The antagonism is fully deserved. The NASEM needs to commission a report explaining why the universities became such one-sided intolerant monocultures and what can be done to fix it, and until they tackle that issue they too deserve the DOGE treatment.

On Thu, May 29, 2025 at 10:09 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/> . A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>

Sent: Thursday, May 29, 2025 9:58 AM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>

Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)

RCP6.0/SSP3-7.0: 8 (4%)

RCP4.5/SSP2-4.5: 66 (33%)

RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679

Culture/Culturally: 854

Equity/Equitable: 572

Sustainable: 295

Inequality/Unequal: 201

Racism/Racial: 153

Low-Income: 105

Injustice: 94

Communities of Color: 67

Minorities: 37



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

DOCUMENT WITHHELD FOR PRIVILEGE

DOCUMENT WITHHELD FOR PRIVILEGE

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Thursday, May 29, 2025 7:28 PM
To: Judith Curry
Cc: Ross McKittrick; John Christy; Roy Spencer; Travis Fisher; Josh Loucks
Subject: Re: NCA5: Scientific assessment or social engineering?

I think OSTP is quite open to suggestions.

One thing that needs to change is to restore the focus to the science.

NCA5 assumes the science is settled, and so gives it pretty short shrift. Instead they concentrate on impacts, equity, etc.

But what we've written shows the science is far from settled.
So NCA needs to get back to basics.

Steven E. Koonin

On May 29, 2025, at 18:07, Judith Curry <curry.judith@gmail.com> wrote:

Your thoughts on our group making a pre-emptive unofficial recommendation on what should be in the next NCA and how the process should proceed? or is there some infrastructure on this that is already underway (i'm out of the loop). Some pre-emptive common sense might be useful

On Thu, May 29, 2025 at 8:20 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I had a first-hand exposure to the NASEM process when I chaired their Divisional Committee for Engineering and Physical Sciences (DEPSCOM) for six years. We oversaw the commissioning, execution, and publication of (I'd guess) more than 100 reports during that time. They were all quite well done, but none of them concerned climate science.

NASEM on climate was an entirely different matter. I got stonewalled when I tried to complain about it to the management. And friends who were on climate-related studies have some horror stories to tell.

I'd hope that if we do a critique of NCA5, we'll also comment on the NASEM role. They really dropped the ball.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Thursday, May 29, 2025 10:53 AM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: John Christy <climateman60@gmail.com>; Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

Without even reading the NASEM report I assume it's useless. The problem is they draw experts from govt agencies and universities. That crowd knows that the NCA serves a partisan purpose so they'll pull their punches to prevent giving fodder to the enemies of the movement.

The data show universities are about 95/5 dems/gop and not only that, but among the dems the party identification is "strong" versus mostly "weak" or "leans" among gop. So draw a random sample from academia (ensuring a "wide range" of views blah blah blah) and you end up with left and further left. Up until recently we had to go along with the illusion that expert panels can be relied upon to provide balanced scientific advice but the obvious bias of the IPCC and NCA, among others (CDC, WHO etc) have killed that expectation. They let themselves be colonized by the left and now they've lost any claim on public trust.

RPJr posted this data from a recent UChicago survey

<image001.png>

Almost 50% of republicans (and 30% of independents) now view ivy league universities not just as useless but as their enemies. The antagonism is fully deserved. The NASEM needs to commission a report explaining why the universities became such one-sided intolerant monocultures and what can be done to fix it, and until they tackle that issue they too deserve the DOGE treatment.

On Thu, May 29, 2025 at 10:09 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/> . A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>

Sent: Thursday, May 29, 2025 9:58 AM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>

Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)

RCP6.0/SSP3-7.0: 8 (4%)

RCP4.5/SSP2-4.5: 66 (33%)

RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679

Culture/Culturally: 854

Equity/Equitable: 572

Sustainable: 295

Inequality/Unequal: 201

Racism/Racial: 153

Low-Income: 105

Injustice: 94

Communities of Color: 67

Minorities: 37



Judith Curry, President
CFAN - Climate Forecast Applications Network
Reno, NV USA
curry.judith@cfanclimate.com | +1.404.803.2012
<http://www.cfanclimate.net>

From: Judith Curry [curry.judith@gmail.com]
Sent: 5/29/2025 10:07:12 PM
To: Steven Koonin [steven.koonin@gmail.com]
CC: Ross McKittrick [ross.mckittrick@gmail.com]; John Christy [climateman60@gmail.com]; Roy Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Josh Loucks [loucksj14@gmail.com]
Subject: Re: NCA5: Scientific assessment or social engineering?

Your thoughts on our group making a pre-emptive unofficial recommendation on what should be in the next NCA and how the process should proceed? or is there some infrastructure on this that is already underway (i'm out of the loop). Some pre-emptive common sense might be useful

On Thu, May 29, 2025 at 8:20 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I had a first-hand exposure to the NASEM process when I chaired their Divisional Committee for Engineering and Physical Sciences (DEPSCOM) for six years. We oversaw the commissioning, execution, and publication of (I'd guess) more than 100 reports during that time. They were all quite well done, but none of them concerned climate science.

NASEM on climate was an entirely different matter. I got stonewalled when I tried to complain about it to the management. And friends who were on climate-related studies have some horror stories to tell.

I'd hope that if we do a critique of NCA5, we'll also comment on the NASEM role. They really dropped the ball.

SEK

From: Ross McKittrick <ross.mckittrick@gmail.com>
Sent: Thursday, May 29, 2025 10:53 AM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: John Christy <climateman60@gmail.com>; Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

Without even reading the NASEM report I assume it's useless. The problem is they draw experts from govt agencies and universities. That crowd knows that the NCA serves a partisan purpose so they'll pull their punches to prevent giving fodder to the enemies of the movement.

The data show universities are about 95/5 dems/gop and not only that, but among the dems the party identification is "strong" versus mostly "weak" or "leans" among gop. So draw a random sample from academia (ensuring a "wide range" of views blah blah blah) and you end up with left and further left. Up until recently we had to go along with the illusion that expert panels can be relied upon to provide balanced scientific advice but the obvious bias of the IPCC and NCA, among others (CDC, WHO etc) have killed that expectation. They let themselves be colonized by the left and now they've lost any claim on public trust.

RPJr posted this data from a recent UChicago survey

[Ivy League Universities like Harvard and Yale]
 ...On a scale of 1 to 5 – where 1 means you think the institution is your enemy and 5 means you think the institution is your friend – where on this scale would you place yourself?

CROSS/NORC 5/01 to 5/05/25	Total	Dem	Ind	Rep
1 - Enemy	11.1%	2.4%	12.2%	20.5%
2	17.2%	8.9%	18.1%	26.2%
3	45.1%	46.5%	50.3%	41.1%
4	14.5%	22.2%	10.4%	7.7%
5 - Friend	10.5%	18.6%	6.0%	3.4%
DON'T KNOW	0.3%	0.4%	0.1%	0.3%
SKIPPED ON WEB	1.3%	1.0%	2.8%	0.7%
N=	2131	1012	322	794

Almost 50% of republicans (and 30% of independents) now view ivy league universities not just as useless but as their enemies. The antagonism is fully deserved. The NASEM needs to commission a report explaining why the universities became such one-sided intolerant monocultures and what can be done to fix it, and until they tackle that issue they too deserve the DOGE treatment.

On Thu, May 29, 2025 at 10:09 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/>. A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>
Sent: Thursday, May 29, 2025 9:58 AM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:
I guess people used to the NCA genre are going to find our report totally off-topic.

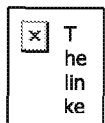
On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:
I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)
RCP6.0/SSP3-7.0: 8 (4%)
RCP4.5/SSP2-4.5: 66 (33%)
RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679
Culture/Culturally: 854
Equity/Equitable: 572
Sustainable: 295
Inequality/Unequal: 201
Racism/Racial: 153
Low-Income: 105
Injustice: 94
Communities of Color: 67
Minorities: 37



Judith Curry, President
CFAN - Climate Forecast Applications
Network
Reno, NV USA
curry.judith@cfanclimate.com |
+1.404.803.2012
<http://www.cfanclimate.net>

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Thursday, May 29, 2025 11:20 AM
To: 'Ross McKitrick'
Cc: 'John Christy'; 'Roy Spencer'; 'Travis Fisher'; 'Judith Curry'; 'Josh Loucks'
Subject: RE: NCA5: Scientific assessment or social engineering?
Attachments: image001.png

I had a first-hand exposure to the NASEM process when I chaired their Divisional Committee for Engineering and Physical Sciences (DEPSCOM) for six years. We oversaw the commissioning, execution, and publication of (I'd guess) more than 100 reports during that time. They were all quite well done, but none of them concerned climate science.

NASEM on climate was an entirely different matter. I got stonewalled when I tried to complain about it to the management. And friends who were on climate-related studies have some horror stories to tell.

I'd hope that if we do a critique of NCA5, we'll also comment on the NASEM role. They really dropped the ball.

SEK

From: Ross McKitrick <ross.mckitrick@gmail.com>
Sent: Thursday, May 29, 2025 10:53 AM
To: Steven Koonin <steven.koonin@gmail.com>
Cc: John Christy <climateman60@gmail.com>; Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

Without even reading the NASEM report I assume it's useless. The problem is they draw experts from govt agencies and universities. That crowd knows that the NCA serves a partisan purpose so they'll pull their punches to prevent giving fodder to the enemies of the movement.

The data show universities are about 95/5 dems/gop and not only that, but among the dems the party identification is "strong" versus mostly "weak" or "leans" among gop. So draw a random sample from academia (ensuring a "wide range" of views blah blah blah) and you end up with left and further left. Up until recently we had to go along with the illusion that expert panels can be relied upon to provide balanced scientific advice but the obvious bias of the IPCC and NCA, among others (CDC, WHO etc) have killed that expectation. They let themselves be colonized by the left and now they've lost any claim on public trust.

RPJr posted this data from a recent UChicago survey

[Ivy League Universities like Harvard and Yale]
 ...On a scale of 1 to 5 – where 1 means you think the institution is your enemy and 5 means you think the institution is your friend – where on this scale would you place yourself?

CPD&T/VORC 5/01 to 5/05/25	Total	Dem	Ind	Rep
1 - Enemy	11.1%	2.4%	12.2%	30.5%
2	17.2%	8.9%	18.1%	28.2%
3	45.1%	48.5%	50.3%	41.1%
4	14.5%	22.2%	10.4%	7.7%
5 - Friend	10.5%	19.6%	6.0%	3.4%
DON'T KNOW	0.3%	0.4%	0.1%	0.3%
SKIPPED ON WEB	1.3%	1.0%	2.8%	0.7%
N=	2131	1012	322	794

Almost 50% of republicans (and 30% of independents) now view ivy league universities not just as useless but as their enemies. The antagonism is fully deserved. The NASEM needs to commission a report explaining why the universities became such one-sided intolerant monocultures and what can be done to fix it, and until they tackle that issue they too deserve the DOGE treatment.

On Thu, May 29, 2025 at 10:09 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I’ve downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There’s very little of the foundational science in its 1834 pages(!) that’s amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors’ responses to that review.

And here’s a link to the “gold standard” EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/> . A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;

- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>
Sent: Thursday, May 29, 2025 9:58 AM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)

RCP6.0/SSP3-7.0: 8 (4%)

RCP4.5/SSP2-4.5: 66 (33%)

RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679

Culture/Culturally: 854

Equity/Equitable: 572

Sustainable: 295

Inequality/Unequal: 201

Racism/Racial: 153

Low-Income: 105

Injustice: 94

Communities of Color: 67

Minorities: 37

From: Roy Spencer <roywspencer@hotmail.com>
Sent: Thursday, May 29, 2025 11:15 AM
To: Steven Koonin; 'John Christy'; 'Ross McKittrick'
Cc: 'Travis Fisher'; 'Judith Curry'; 'Josh Loucks'
Subject: Re: NCA5: Scientific assessment or social engineering?

I read some of the NAS review of NCA5 this morning... absolutely glowing praise. It applauded the inclusion of DEI and minorities-to-be-hardest-hit language.

It also says there are over 500 authors of NCA5, which includes racial balance as a criterion for inclusion.

I re-read the 1990 Act creating the USGCRP, and it only mentions an NRC review of the multi-agency research PLAN, not the NCAs. So, I assume the NAS review was just to add gravitas to the 500+ authors?

-Roy

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Thursday, May 29, 2025 9:09 AM
To: 'John Christy' <climateman60@gmail.com>; 'Ross McKittrick' <ross.mckittrick@gmail.com>
Cc: 'Roy Spencer' <roywspencer@hotmail.com>; 'Travis Fisher' <travis.scott.fisher@gmail.com>; 'Judith Curry' <curry.judith@gmail.com>; 'Josh Loucks' <loucksj14@gmail.com>
Subject: RE: NCA5: Scientific assessment or social engineering?

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/> . A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>
Sent: Thursday, May 29, 2025 9:58 AM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin

<steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>

Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)

RCP6.0/SSP3-7.0: 8 (4%)

RCP4.5/SSP2-4.5: 66 (33%)

RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679

Culture/Culturally: 854

Equity/Equitable: 572

Sustainable: 295

Inequality/Unequal: 201

Racism/Racial: 153

Low-Income: 105

Injustice: 94

Communities of Color: 67

Minorities: 37

From: Ross McKittrick [ross.mckittrick@gmail.com]
Sent: 5/29/2025 2:52:50 PM
To: Steven Koonin [steven.koonin@gmail.com]
CC: John Christy [climateman60@gmail.com]; Roy Spencer [roywspencer@hotmail.com]; Travis Fisher [travis.scott.fisher@gmail.com]; Judith Curry [curry.judith@gmail.com]; Josh Loucks [loucksj14@gmail.com]
Subject: Re: NCA5: Scientific assessment or social engineering?

Without even reading the NASEM report I assume it's useless. The problem is they draw experts from govt agencies and universities. That crowd knows that the NCA serves a partisan purpose so they'll pull their punches to prevent giving fodder to the enemies of the movement.

The data show universities are about 95/5 dems/gop and not only that, but among the dems the party identification is "strong" versus mostly "weak" or "leans" among gop. So draw a random sample from academia (ensuring a "wide range" of views blah blah blah) and you end up with left and further left. Up until recently we had to go along with the illusion that expert panels can be relied upon to provide balanced scientific advice but the obvious bias of the IPCC and NCA, among others (CDC, WHO etc) have killed that expectation. They let themselves be colonized by the left and now they've lost any claim on public trust.

RPJr posted this data from a recent UChicago survey

[Ivy League Universities like Harvard and Yale]

...On a scale of 1 to 5 – where 1 means you think the institution is your enemy and 5 means you think the institution is your friend – where on this scale would you place yourself?

CPOST/NORC 5/01 to 5/05/25	Total	Dem	Ind	Rep
1 - Enemy	11.1%	2.4%	12.2%	20.5%
2	17.2%	8.9%	18.1%	26.2%
3	45.1%	48.5%	50.3%	41.1%
4	14.5%	22.2%	10.4%	7.7%
5 - Friend	10.5%	18.6%	6.0%	3.4%
DON'T KNOW	0.3%	0.4%	0.1%	0.3%
SKIPPED ON WEB	1.3%	1.0%	2.8%	0.7%
N=	2131	1012	322	794

Almost 50% of republicans (and 30% of independents) now view ivy league universities not just as useless but as their enemies. The antagonism is fully deserved. The NASEM needs to commission a report explaining why the universities became such one-sided intolerant monocultures and what can be done to fix it, and until they tackle that issue they too deserve the DOGE treatment.

On Thu, May 29, 2025 at 10:09 AM Steven Koonin <steven.koonin@gmail.com> wrote:

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/>. A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>

Sent: Thursday, May 29, 2025 9:58 AM

To: Ross McKittrick <ross.mckittrick@gmail.com>

Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>

Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)

RCP6.0/SSP3-7.0: 8 (4%)

RCP4.5/SSP2-4.5: 66 (33%)

RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679

Culture/Culturally: 854
Equity/Equitable: 572
Sustainable: 295
Inequality/Unequal: 201
Racism/Racial: 153
Low-Income: 105
Injustice: 94
Communities of Color: 67
Minorities: 37

From: Steven Koonin <steven.koonin@gmail.com>
Sent: Thursday, May 29, 2025 10:10 AM
To: 'John Christy'; 'Ross McKittrick'
Cc: 'Roy Spencer'; 'Travis Fisher'; 'Judith Curry'; 'Josh Loucks'
Subject: RE: NCA5: Scientific assessment or social engineering?
Attachments: NASEM Review of NCA5.pdf; NCA5_Author-Responses-to-NASEM.pdf

I've downloaded the report (<https://nca2023.globalchange.gov/downloads/>) There's very little of the foundational science in its 1834 pages(!) that's amenable to serious scientific critique.

I also attach the NASEM review of the NCA5 draft, as well as the authors' responses to that review.

And here's a link to the "gold standard" EO: <https://www.whitehouse.gov/presidential-actions/2025/05/restoring-gold-standard-science/> . A reminder that its criteria are:

- (i) reproducible;
- (ii) transparent;
- (iii) communicative of error and uncertainty;
- (iv) collaborative and interdisciplinary;
- (v) skeptical of its findings and assumptions;
- (vi) structured for falsifiability of hypotheses;
- (vii) subject to unbiased peer review;
- (viii) accepting of negative results as positive outcomes; and
- (ix) without conflicts of interest.

SEK

From: John Christy <climateman60@gmail.com>
Sent: Thursday, May 29, 2025 9:58 AM
To: Ross McKittrick <ross.mckittrick@gmail.com>
Cc: Roy Spencer <roywspencer@hotmail.com>; Travis Fisher <travis.scott.fisher@gmail.com>; Steven Koonin <steven.koonin@gmail.com>; Judith Curry <curry.judith@gmail.com>; Josh Loucks <loucksj14@gmail.com>
Subject: Re: NCA5: Scientific assessment or social engineering?

This mirrors the word usage from the briefing we received from the head of NCA5.

John C.

On Thu, May 29, 2025 at 8:56 AM Ross McKittrick <ross.mckittrick@gmail.com> wrote:

I guess people used to the NCA genre are going to find our report totally off-topic.

On Thu, May 29, 2025 at 7:01 AM Roy Spencer <roywspencer@hotmail.com> wrote:

I did keyword counts in NCA5, and got the following results:

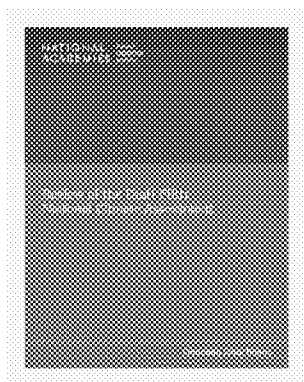
Mentions of RCP/SSP Scenarios (other than definitions):

RCP8.5/SSP5-8.5: 105 (53%)
RCP6.0/SSP3-7.0: 8 (4%)
RCP4.5/SSP2-4.5: 66 (33%)
RCP2.6/SSP1-2.6: 19 (10%)

Social/Societal keywords

Indigenous/Tribes/Tribal: 1,679
Culture/Culturally: 854
Equity/Equitable: 572
Sustainable: 295
Inequality/Unequal: 201
Racism/Racial: 153
Low-Income: 105
Injustice: 94
Communities of Color: 67
Minorities: 37

This PDF is available at <http://nap.nationalacademies.org/26757>



Review of the Draft Fifth National Climate Assessment (2023)

DETAILS

344 pages | 8.5 x 11 | PAPERBACK

ISBN 978-0-309-69523-7 | DOI 10.17226/26757

CONTRIBUTORS

Committee to Review the Draft Fifth National Climate Assessment; Board on Atmospheric Sciences and Climate; Board on Environmental Change and Society; Division on Earth and Life Studies; Division of Behavioral and Social Sciences and Education; National Academies of Sciences, Engineering, and Medicine

BUY THIS BOOK

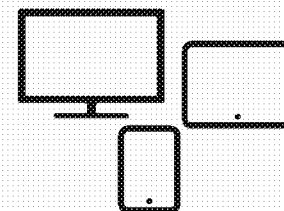
FIND RELATED TITLES

SUGGESTED CITATION

National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26757>.

Visit the National Academies Press at nap.edu and login or register to get:

- Access to free PDF downloads of thousands of publications
- 10% off the price of print publications
- Email or social media notifications of new titles related to your interests
- Special offers and discounts



All downloadable National Academies titles are free to be used for personal and/or non-commercial academic use. Users may also freely post links to our titles on this website; non-commercial academic users are encouraged to link to the version on this website rather than distribute a downloaded PDF to ensure that all users are accessing the latest authoritative version of the work. All other uses require written permission. (Request Permission)

This PDF is protected by copyright and owned by the National Academy of Sciences; unless otherwise indicated, the National Academy of Sciences retains copyright to all materials in this PDF with all rights reserved.

Review of the Draft Fifth National Climate Assessment

Committee to Review the Draft Fifth National Climate Assessment

Board on Atmospheric Sciences and Climate

Division on Earth and Life Studies

Board on Environmental Change and Society

Division of Behavioral and Social Sciences and Education

Consensus Study Report

NATIONAL ACADEMIES PRESS 500 Fifth Street, NW Washington, DC 20001

This activity was supported by a contract between the National Academy of Sciences and the National Aeronautics and Space Administration. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project.

International Standard Book Number-13: 978-0-309-69523-7

International Standard Book Number-10: 0-309-69523-6

Digital Object Identifier: <https://doi.org/10.17226/26757>

This publication is available from the National Academies Press, 500 Fifth Street, NW, Keck 360, Washington, DC 20001; (800) 624-6242 or (202) 334-3313; <http://www.nap.edu>.

Copyright 2023 by the National Academy of Sciences. National Academies of Sciences, Engineering, and Medicine and National Academies Press and the graphical logos for each are all trademarks of the National Academy of Sciences. All rights reserved.

Printed in the United States of America.

Suggested citation: National Academies of Sciences, Engineering, and Medicine. 2023. *Review of the Draft Fifth National Climate Assessment*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26757>.

The **National Academy of Sciences** was established in 1863 by an Act of Congress, signed by President Lincoln, as a private, nongovernmental institution to advise the nation on issues related to science and technology. Members are elected by their peers for outstanding contributions to research. Dr. Marcia McNutt is president.

The **National Academy of Engineering** was established in 1964 under the charter of the National Academy of Sciences to bring the practices of engineering to advising the nation. Members are elected by their peers for extraordinary contributions to engineering. Dr. John L. Anderson is president.

The **National Academy of Medicine** (formerly the Institute of Medicine) was established in 1970 under the charter of the National Academy of Sciences to advise the nation on medical and health issues. Members are elected by their peers for distinguished contributions to medicine and health. Dr. Victor J. Dzau is president.

The three Academies work together as the **National Academies of Sciences, Engineering, and Medicine** to provide independent, objective analysis and advice to the nation and conduct other activities to solve complex problems and inform public policy decisions. The National Academies also encourage education and research, recognize outstanding contributions to knowledge, and increase public understanding in matters of science, engineering, and medicine.

Learn more about the National Academies of Sciences, Engineering, and Medicine at **www.nationalacademies.org**.

Consensus Study Reports published by the National Academies of Sciences, Engineering, and Medicine document the evidence-based consensus on the study's statement of task by an authoring committee of experts. Reports typically include findings, conclusions, and recommendations based on information gathered by the committee and the committee's deliberations. Each report has been subjected to a rigorous and independent peer-review process and it represents the position of the National Academies on the statement of task.

Proceedings published by the National Academies of Sciences, Engineering, and Medicine chronicle the presentations and discussions at a workshop, symposium, or other event convened by the National Academies. The statements and opinions contained in proceedings are those of the participants and are not endorsed by other participants, the planning committee, or the National Academies.

Rapid Expert Consultations published by the National Academies of Sciences, Engineering, and Medicine are authored by subject-matter experts on narrowly focused topics that can be supported by a body of evidence. The discussions contained in rapid expert consultations are considered those of the authors and do not contain policy recommendations. Rapid expert consultations are reviewed by the institution before release.

For information about other products and activities of the National Academies, please visit www.nationalacademies.org/about/whatwedo.

COMMITTEE TO REVIEW THE DRAFT FIFTH NATIONAL CLIMATE ASSESSMENT

JOEL B. SMITH (*Chair*), Independent Researcher
MARISSA AHO, Washington State Department of Natural Resources
SHANONDORA BILLIOT, Arizona State University
MICHAEL DETTINGER (NAE), Scripps Institution of Oceanography and Desert
Research Institute
JANET FRANKLIN (NAS), San Diego State University
JADA GAROFALO, Abt Associates
SHINENG HU, Duke University
RICHARD JACKSON (NAM), University of California, Los Angeles
RACHAEL JONASSEN, The George Washington University
NATALIE MAHOWALD, Cornell University
REGAN F. PATTERSON, University of California, Los Angeles
YEUMING (LUCY) QIU, University of Maryland, College Park
CHARLES (CHUCK) RICE, Kansas State University
ANJALI SAUTHOFF, Independent Environmental Health Scientist
DAVID L. SKOLE, Michigan State University
PHILIP R. THOMPSON, University of Hawai‘i at Mānoa
KRISTIN TIMM, International Arctic Research Center, University of Alaska Fairbanks
GARY YOHE, Wesleyan University (*Emeritus*)

Study Staff

MORGAN DISBROW-MONZ, Study Director
RACHEL SILVERN, Program Officer
STEVEN STICHTER, Senior Program Officer
HANNAH STEWART, Associate Program Officer
LINDSAY MOLLER, Senior Program Assistant

BOARD ON ATMOSPHERIC SCIENCES AND CLIMATE

MARY GLACKIN (*Chair*), The Weather Company, an IBM Business (Retired)
CYNTHIA S. ATHERTON, Heising-Simons Foundation
ELIZABETH A. BARNES, Colorado State University
BRAD R. COLMAN, The Climate Corporation (Retired)
BART E. CROES, California Air Resources Board (Retired)
NEIL DONAHUE, Carnegie Mellon University
ROBERT B. DUNBAR, Stanford University
LESLEY-ANN DUPIGNY-GIROUX, University of Vermont
EFI FOUFOULA-GEORGIU (NAE), University of California, Irvine
PETER C. FRUMHOFF, Union of Concerned Scientists
ROBERT KOPP, Rutgers University, The State University of New Jersey
RUBY LEUNG (NAE), Pacific Northwest National Laboratory
ZHANQING LI, University of Maryland
JONATHAN MARTIN, University of Wisconsin–Madison
AMY McGOVERN, Oklahoma State University
LINDA O. MEARNS, National Center for Atmospheric Research
JONATHAN A. PATZ (NAM), University of Wisconsin–Madison
J. MARSHALL SHEPHERD (NAS/NAE), University of Georgia
DAVID W. TITLEY, US Navy (Retired) and The Pennsylvania State University
ARADHNA TRIPATI, University of California, Los Angeles
ELKE U. WEBER (NAS), Princeton University

National Academies of Sciences, Engineering, and Medicine Staff

AMANDA STAUDT, Senior Board Director
APURVA DAVE, Senior Program Officer
APRIL MELVIN, Senior Program Officer
AMANDA PURCELL, Senior Program Officer
STEVEN STICHTER, Senior Program Officer
ALEX REICH, Program Officer
RACHEL SILVERN, Program Officer
MORGAN DISBROW-MONZ, Associate Program Officer
BRIDGET McGOVERN, Associate Program Officer
PATRICIA RAZAFINDRAMBININA, Associate Program Officer
HUGH WALPOLE, Associate Program Officer
RITA GASKINS, Administrative Coordinator
AMY MITSUMORI, Research Associate
ROB GREENWAY, Program Associate
KYLE ALDRIDGE, Senior Program Assistant
LINDSAY MOLLER, Senior Program Assistant
SABAH RANA, Senior Program Assistant
RACHEL SANCHEZ, Program Assistant

BOARD ON ENVIRONMENTAL CHANGE AND SOCIETY

KRIS EBI (*Chair*), University of Washington

BILAL M. AYYUB, University of Maryland, College Park

LISA DILLING, University of Colorado Boulder and Cooperative Institute for Research in
Environmental Sciences

KENNETH GILLINGHAM, Yale University (Emeritus)

LORI HUNTER, University of Colorado Boulder

KATHARINE L. JACOBS, Center for Climate Adaptation Science and Solutions and
University of Arizona

STEPHEN H. LINDER, University of Texas Health Science Center at Houston

GARY E. MACHLIS, Clemson University

MICHAEL A. MÉNDEZ, University of California, Irvine

ASEEM PRAKASH, University of Washington

BENJAMIN K. SOVACOOOL, Boston University

MICHAEL VANDENBERGH, Vanderbilt University

CATHY L. WHITLOCK (NAS), Montana State University

National Academies of Sciences, Engineering, and Medicine Staff

THOMAS THORNTON, Board Director

SITARA RAHIAB, Senior Program Officer

JOHN BEN SOILEAU, Program Officer

SHARON BRITT, Program Coordinator

HANNAH STEWART, Associate Program Officer

GRACE BETTS, Research Associate

Reviewers

This Consensus Study Report was reviewed in draft form by individuals chosen for their diverse perspectives and technical expertise. The purpose of this independent review is to provide candid and critical comments that will assist the National Academies of Sciences, Engineering, and Medicine in making each published report as sound as possible and to ensure that it meets the institutional standards for quality, objectivity, evidence, and responsiveness to the study charge. The review comments and draft manuscript remain confidential to protect the integrity of the deliberative process.

We thank the following individuals for their review of this report:

KAREN AKERLOF, George Mason University
PHILIP ARDANUY, INNOVIM, LLC
ANA DIEZ ROUX (NAM), Drexel University
ALISON EAGLE, Environmental Defense Fund
TONYA GRAHAM, Geos Institute
ROBERT KOPP, Rutgers University
JULIE PULLEN, Propellor
JULIE RAYMOND-YAKOUBIAN, Kawerak, Inc.
LORETTA SINGLETARY, University of Nevada, Reno
CATHY WHITLOCK (NAS), Montana State University

Although the reviewers listed above provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations of this report, nor did they see the final draft before its release. The review of this report was overseen by **KAI LEE**, Owl of Minerva, LLC, and **ANTONIO BUSALACCHI (NAE)**, University Corporation for Atmospheric Research. They were responsible for making certain that an independent examination of this report was carried out in accordance with the standards of the National Academies and that all review comments were carefully considered. Responsibility for the final content rests entirely with the authoring committee and the National Academies.

Contents

Summary	1
1 Introduction	5
The Committee’s Approach to This Report, 6	
Report Roadmap, 7	
2 Overarching Comments and Recommendations	9
Notes of Praise, 9	
Addressing the Mandate in the Global Change Research Act of 1990, 10	
Recommendations for Consistent Structures, 12	
Additional Inconsistencies Between Chapters, 22	
Recommendations on Equity and Justice, 27	
Areas to Add Emphasis, 30	
3 Chapter Comments	35
Chapter 0: Front Matter, 35	
Chapter 1: Overview, 36	
Chapter 2: Climate Trends, 42	
Chapter 3: Earth System Processes, 47	
Chapter 4: Water, 53	
Chapter 5: Energy Supply, Delivery, and Demand, 62	
Chapter 6: Land Cover and Land-Use Change, 68	
Chapter 7: Forests, 74	
Chapter 8: Ecosystems, Ecosystem Services, and Biodiversity, 83	
Chapter 9: Coastal Effects, 89	
Chapter 10: Oceans and Marine Resources, 100	
Chapter 11: Agriculture, Food Systems, and Rural Communities, 103	
Chapter 12: Built Environment, Urban Systems, and Cities, 109	
Chapter 13: Transportation, 114	
Chapter 14: Air Quality, 118	
Chapter 15: Human Health, 121	
Chapter 16: Tribes and Indigenous Peoples, 128	
Chapter 17: Climate Effects on US International Interests, 133	
Chapter 18: Sector Interactions, Multiple Stressors, and Complex Systems, 141	
Chapter 19: Economics, 147	
Chapter 20: Social Systems and Justice, 152	
Chapter 21: Northeast, 155	
Chapter 22: Southeast, 162	
Chapter 23: US Caribbean, 165	
Chapter 24: Midwest, 170	
Chapter 25: Northern Great Plains, 177	

Chapter 26: Southern Great Plains, 183	
Chapter 27: Northwest, 187	
Chapter 28: Southwest, 194	
Chapter 29: Alaska, 202	
Chapter 30: Hawai‘i and US-Affiliated Pacific Islands, 207	
Chapter 31: Adaptation, 213	
Chapter 32: Mitigation, 218	
Focus on Compound and Complex Events, 227	
Focus on Western Wildfires, 230	
Focus on COVID-19 and Climate Change, 234	
Focus on Risks to Supply Chains, 236	
Focus on Blue Carbon, 238	
Appendix 3: Scenarios and Datasets, 240	
Appendix 4: Indicators, 240	
References	243
Appendix A Line-by-Line Comments	267
Appendix B Committee Member Biographical Sketches	325

Summary

The US Global Change Research Program (USGCRP) is mandated to develop an assessment of global change every four years or less. The Fifth National Climate Assessment (NCA5) is the latest in a series of sustained assessments that evaluate the state of global change science and analyze the wide range of impacts of climate change in the United States. The assessments represent a consensus-based view of the state of knowledge, relevant for policy and decision making.

The draft NCA5 report reviewed here addresses a wide range of topics of high importance to the United States and society more broadly, extending from human health and community well-being to the built environment, to businesses and economies, and to ecosystems and water resources. NCA5 is a unique opportunity to examine the impacts of current and projected climate change on each region of the United States. Hundreds of experts representing federal, state, and local governments; academia; non-governmental organizations; and the private sector developed the draft NCA5 report, with further input from community engagement events and public comment. The scale of collaboration is the largest for any National Climate Assessment (NCA) to date. The impressive and rich array of perspectives introduced through the NCA5 writing process provides an opportunity to develop a foundational climate change report that informs and highlights adaptation and mitigation efforts and serves as a valuable resource for broad audiences.

The National Academies of Sciences, Engineering, and Medicine convened an ad hoc Committee to Review the Draft Fifth National Climate Assessment (the “Committee”). The Committee is charged with providing a comprehensive, independent review of the draft NCA5 report, concurrent with the public comment period. In its review, the Committee evaluated the draft NCA5 report to determine whether it meets the requirements of the federal mandate; provides accurate information grounded in the scientific literature; and effectively communicates climate science, impacts, and responses for general audiences including the public, decision makers, and other stakeholders (see Chapter 1 of this report for the Committee’s complete Statement of Task). Chapter 2 of this report synthesizes the Committee’s overarching comments on the draft NCA5 report and makes recommendations for improvement. Chapter 3 provides detailed comments on each individual chapter of the draft NCA5 report, and Appendix A includes detailed line-by-line comments. The Committee’s approach to this review was to provide constructive comments and specific suggestions to strengthen the accuracy, consistency, credibility, and accessibility of the key messages and supporting text in the draft NCA5 report.

The Committee applauds the NCA5 authors for their outstanding job assembling, researching, and interpreting the vast knowledge of an extremely complex and rapidly changing topic—climate change impacts, adaptation, and mitigation in the United States. The Committee also commends the NCA process for its use of traceable accounts to accurately document the state of knowledge—including emerging and remaining gaps in knowledge—regarding the impacts of climate change. The draft NCA5 report gives significant attention to matters of equity and justice—a substantial and long-overdue improvement over past NCAs. The Committee appreciates the attention to evaluating climate change impacts and responses through the lens of equity and justice. The Committee also commends the NCA5 authors for identifying progress the United States has made in adapting to climate change, particularly providing examples of successful adaptations by local and tribal communities.

Clear and consistent structures support the ability of NCA5 to reach its target audiences effectively, thereby enhancing the credibility and usability of the report. In order for the draft NCA5 report to better provide a clear, thorough, and credible encapsulation of the knowledge base of the impacts of climate change on the United States, the Committee recommends that consistent structures be adopted to make the report accessible to the target audiences:

1. **Key message “labels” and “titles” should follow a common structure throughout the report.**
2. **The “message” part of each key message should have a consistent reading level, length, and voice throughout the report.**
3. **Confidence and likelihood statements should be used consistently for each claim across all key messages, and readers should be able to readily understand what is meant by confidence and likelihood.**
4. **A consistent framework for traceable accounts sections would better support the key messages and build consistency and credibility across chapters.**
5. **The introduction to each chapter should be consistent in length, depth of content, relationship to key messages, and voice; new terminology should also be introduced in a consistent manner.**

It is vital that key messages throughout the report are crafted consistently and carefully. Key messages should incorporate and express the knowledge base through the use of appropriate confidence and likelihood levels and be carefully written so that findings can be understood by broad audiences and not taken out of context. Special attention is needed to ensure confidence and likelihood statements convey important context to readers about claims made in the key messages. Similarly, traceable accounts provide credibility and transparency to each key message and associated text; thus, a framework is recommended to build consistency and credibility for this important section. While it is appropriate for the text supporting the key messages to look different from one chapter to another, consistent introductory sections would provide readers with the appropriate context and a roadmap to understand the rest of the chapter.

Overall, the Committee is impressed with the graphics throughout the draft NCA5 report. Considering that figures and boxes are opportunities to meaningfully convey information to the broadest possible audiences, the Committee recommends the following:

6. **All figures, figure captions, and figure citations should be consistent and self-contained.**
7. **Boxes within chapters should be used to highlight specific examples or to summarize or improve message accessibility.**

The Committee recommends making figures and their captions self-contained such that the reader can easily understand the key ideas related to the figure without reading the supporting chapter text. The Committee also suggests that figures adhere to basic principles of design, including through the use of consistent titles, colors, and symbols. The use and content of boxes could also be more effective if reserved for specific types of content (i.e., firsthand stories, examples, complex concepts, an important figure). When possible, boxes could be better utilized to communicate a message that is not clearly expressed in the main text or needs amplification.

In addition to the structural issues raised above, there are a number of other inconsistencies across the draft NCA5 report that pertain to the ways topics and terms are structured and discussed. While it is appropriate for chapter authors to design their chapters to meet specific topical needs, there are certain content areas that would benefit from more consistent treatment throughout the draft NCA5 report to strengthen the credibility of key messages and enhance clarity and readability:

- 8. The draft NCA5 report should be revised to address inconsistencies across chapters, including treatment of adaptation and mitigation, distinction between natural variability and climate change, use of scenarios, treatment of Focus On... Features, and the use of terminology.**
- 9. The draft NCA5 report should be revised to utilize and distinguish between the different use cases of sea-level rise projections and sea-level rise scenarios clearly and consistently.**
- 10. Individual chapters across the draft NCA5 report—particularly national and regional chapters—should be better integrated and cross-referenced.**

Where inconsistencies in structure and content between chapters cannot otherwise be resolved, the Front Matter could explain these differences. Overall, stronger cross-referencing and integration between chapters would reduce redundancies and inconsistencies, create more space for authors to expand on certain topics, and strengthen connections between national and regional topics.

The Committee commends the NCA5 authors for incorporating equity and justice into the report; however, there are opportunities to more intentionally and consistently integrate issues related to equity and justice throughout the report to highlight systemic interconnections. To that end, the Committee makes the following recommendations:

- 11. For consistency, chapter introductions should include context on equity and justice as related to the chapter topic. To move beyond general statements, different dimensions of justice, including distributional, procedural, recognition, and intergenerational justice, should be addressed as appropriate throughout the chapter text. Related gaps in the literature should be identified in the text and traceable accounts.**
- 12. A glossary of terms related to equity and justice should be adopted and/or developed to ensure consistent use of terminology across NCA5. Associated references should be provided.**
- 13. To provide equitable access to climate-related information across US communities, national chapters should include all US islands and territories in their figures and assessments whenever possible.**

Finally, in reviewing the draft NCA5 report as a whole, the Committee recommends more thorough attention should be given to certain topical areas:

- 14. Relatively more emphasis should be placed on the topics of: mitigation, adaptation successes and shortcomings, projected impacts of climate change, attribution of extreme events, and rural analysis.**

1

Introduction

The Global Change Research Act of 1990 mandates the US Global Change Research Program (USGCRP) develop an assessment of global change every four years or less. The Fifth National Climate Assessment (NCA5) is the latest in a series of sustained assessments that evaluate the state of global change science and analyze the wide range of impacts of climate change in the United States. The assessments represent a consensus-based view of the state of the science and, although they are relevant for policy and decision making, they do not prescribe policy interventions (Crimmins, 2022). The first National Climate Assessment (NCA) was produced in 2001 (National Assessment Synthesis Team, 2001), the second in 2009 (Karl et al., 2009), the third in 2014 (Melillo et al., 2014), and the fourth in two volumes—volume I in 2017 (USGCRP, 2017) and volume II in 2018 (USGCRP, 2018a).

The National Academies of Sciences, Engineering, and Medicine (the National Academies) have a long history of providing advice to USGCRP by conducting formal reviews of the NCAs, USGCRP strategic plans, and other USGCRP products (NASEM, 2017a). Foundational National Academies reviews of USGCRP programs include National Research Council (2003) and (2004). Recent examples of National Academies reviews include the draft Fourth National Climate Assessment (NASEM, 2018a; USGCRP, 2018a), the draft Climate Science Special Report (NASEM, 2017b; USGCRP, 2017), the draft Second State of the Carbon Cycle Report (NASEM, 2018b; USGCRP, 2018b), the draft Third National Climate Assessment (Melillo et al., 2014; NRC, 2013), and the draft assessment on the impacts of climate change on human health (NASEM, 2015; USGCRP, 2016).

These reviews are authored by ad hoc committees or by the Committee to Advise the USGCRP. Established in July 2011, the Committee to Advise the USGCRP provides broad, ongoing advice from across the National Academies to the USGCRP. It also serves as a point of contact through which USGCRP can gain access to expertise throughout the National Academies for advice on specific aspects of the program. The National Academies convened an ad hoc Committee to Review the Draft Fifth National Climate Assessment (the “Committee”). The Committee is charged with providing a comprehensive, independent review of the draft NCA5 report, concurrent with the public comment period. The complete Statement of Task for the Committee’s review is provided in Box 1-1.

A number of elements are new to NCA5. Compared to the Fourth NCA, the draft NCA5 report added chapters on economics (Chapter 19) and social systems and justice (Chapter 20) and divided the physical science chapter into two chapters (Chapter 2 on Climate Trends and Chapter 3 on Earth System Processes). Also new to NCA5 are five “Focus On... Features” on topics that span multiple chapters. The NCA5 author team is larger and more diverse, with more than 500 authors and technical contributors. The NCA5 authors have also placed particular emphasis on figures, science communication, equity and justice, and the development of a web-first format for the report.

There were several opportunities for public engagement with the development of the draft NCA5 report, including engagement workshops, a call for technical input, calls for comment on the draft prospectus and the annotated outline for the draft NCA5 report, and two calls for artwork.

BOX 1-1
Statement of Task

An ad hoc committee will conduct a review of the Draft Fifth National Climate Assessment, concurrent with the public comment period. The committee will incorporate diversity, equity, inclusion, and justice principles in its review. The committee's review will address the following questions about the draft report:

1. Does the draft assessment meet the requirements of Section 106 of the Global Change Research Act?
2. Do the key messages reflect current understanding about observed and projected impacts to the United States, the challenges, opportunities, and success stories for addressing risk, and identification of emerging issues related to climate change?
3. Does the draft assessment accurately reflect the peer-reviewed scientific literature or other source information cited, with a particular focus on literature since the last National Climate Assessment?
4. Does the draft assessment appropriately identify and provide sufficient context for embedded content, and does this content reflect current scientific understanding?
5. Are there any critical content areas missing from the draft assessment and not adequately addressed by embedded content or references?
6. Are the findings documented in a consistent, transparent, and credible way?
7. Is the draft assessment written at a technical level that is appropriate for the intended audience?
8. Are the draft assessment's key messages and graphics clear, internally consistent, and appropriate? Specifically, do they reflect supporting evidence, include an assessment of likelihood, and communicate effectively?
9. Are the data and analyses handled in a consistent, transparent, and credible manner? Are statistical methods applied appropriately?
10. What other significant improvements, if any, might be made in the draft assessment?

THE COMMITTEE'S APPROACH TO THIS REPORT

During fall 2022, the National Academies appointed the Committee, which is composed of 18 members who have expertise in climate change science, vulnerability, and adaptation in the regions and sectors covered in NCA5. Committee members were not authors of or technical contributors to the draft NCA5 report. The draft NCA5 report was released to both the Committee and the public on November 7, 2022. In addressing its tasks, the Committee met virtually three times from November to December 2022. The Committee held one open-session meeting to learn more about NCA5 and ask questions of the Director of the National Climate Assessment and other NCA5 authors. Individual chapters were reviewed by small teams of Committee members. In addition to chapter review teams, Committee members looked across the entire draft NCA5 report with particular attention to how well it addresses equity and justice and how clearly and accurately the report communicates the state of knowledge on climate change science. The Committee's review was restricted to figures that had cleared copyright by January 27, 2023, and did not include other elements not available to the Committee, including the Glossary that is currently under development. Following the standard National Academies' procedures, the Committee's draft report then underwent a rigorous process of external peer review before publication.

REPORT ROADMAP

This report serves as the Committee’s comprehensive review of the draft NCA5 report. After this brief introduction (Chapter 1), Chapter 2 synthesizes the Committee’s overarching comments on the draft NCA5 report and makes recommendations for improvement. These comments cover both the structure across and within chapters as well as content across the entire draft NCA5 report. Chapter 3 provides detailed comments on each individual chapter as well as the five Focus On... Features, the Front Matter, and Appendixes 3 and 4; comments closely follow the questions in the Committee’s Statement of Task (Box 1-1). The individual chapter reviews use a common structure with a summary followed by comments on the introduction, key message and supporting text language, traceable accounts, graphics and boxes, equity and justice, data and analyses, literature cited, and other recommended changes, as applicable. Appendix A includes detailed line-by-line comments on each chapter in the draft NCA5 report. The Committee’s approach to this review was to provide constructive comments and specific suggestions to strengthen the accuracy, consistency, credibility, and accessibility of the key messages and supporting text in the draft NCA5 report. The Committee recognizes that NCA5 authors have limitations regarding structure and length and this review is careful to suggest places to eliminate writing where the Committee also suggests adding material. In its review, the Committee uses the term “climate change” to refer to anthropogenic climate change.

The primary audiences of NCA5 are “decision makers” including federal agencies, local and state governments, tribes, health care providers, educators, business owners, and the media (Allison Crimmins, personal communication). In its review, the Committee thought carefully about the audiences for NCA5 while developing recommendations related to effective communication. Tailoring communication to specific audiences is one of the fundamental principles of strategic science communication (Besley and Dudo, 2022) and contributes to desirable audience outcomes (Bostrom et al., 2013). Considering the breadth of potential audiences and users of NCA5 requires authors to communicate findings in a way that enhances accessibility while maintaining accuracy. When assessing whether the draft NCA5 report was written at an appropriate technical level, the Committee focused on two different target audiences—a broad audience base and a more technical audience base. Specifically, the Committee assessed chapter introductions, key messages and associated text, and figures from the perspective of targeting the broadest possible audiences, while the Committee expected the traceable accounts to target more technical audiences (e.g., the scientific research community). The Committee also considered how broad audiences might use some parts of the report, such as key messages, boxes, and figures.

2

Overarching Comments and Recommendations

The Committee applauds the Fifth National Climate Assessment (NCA5) authors for an impeccably researched, assembled, and interpreted vast body of literature on an extremely complex and rapidly changing topic—climate change impacts, adaptation, and mitigation in the United States. This is no easy task and is increasingly challenging as the knowledge base on climate change (e.g., the literature, action on climate change mitigation and adaptation) has dramatically expanded in recent decades, particularly since the last National Climate Assessment (NCA) report was released in 2018. The Committee also commends the NCA process for the inclusion of traceable accounts sections at the end of each chapter to describe the process and rationale authors used to develop the chapter and reach consensus on key messages. These sections support the ability of the draft NCA5 report to accurately document the state of knowledge—including recent additions and remaining gaps in knowledge—regarding the impacts of climate change.

The Committee has many recommendations on how the draft NCA5 report can be revised to more clearly and credibly communicate its contents and add emphasis to better balance the state of knowledge on climate change. These recommendations are intended to support the overall goal of NCA5, which is to report on: the scientific understanding of climate change, how climate change already has and is expected to further affect the United States, and what can be done to mitigate and adapt to climate change. Before discussing the recommendations for revising the draft NCA5 report, the Committee outlines some of the many aspects of the report that deserve note and praise.

NOTES OF PRAISE

The draft NCA5 report gives significant attention to matters of equity and justice. This is a substantial and long-overdue improvement over past NCAs, and the Committee appreciates the attention to evaluating climate change impacts and responses through the lens of equity and justice. This attention to equity and justice is notable in many ways, including in the identification of overburdened communities, disproportionate consequences, and systemic drivers of vulnerability, particularly for tribal and other frontline communities in urban and rural areas. The Committee commends the NCA5 authors for using traditional knowledge in its assessment such as in Chapters 16 (Tribes and Indigenous Peoples), 29 (Alaska), and 30 (Hawai‘i and US-Affiliated Pacific Islands).

The Committee commends the NCA5 authors for identifying progress the United States has made in adapting to climate change, particularly at the state and local levels. The regional chapters review state-level adaptations and highlight promising examples of local-level adaptations, including actions of tribal communities. Chapter 31 (Adaptation) strikes the appropriate tone describing how adaptation measures to date appear to be insufficient to address the growing risks from climate change and that transformative adaptation as well as increased funding and technical support will be needed. Given the strong attention the report devotes to adaptation, there is an opportunity to give a similar treatment to mitigation actions, noted below.

Lastly, the draft NCA5 report has done a better job than previous NCAs of characterizing the Representative Concentration Pathway (RCP) scenarios used in recent Intergovernmental Panel on Climate Change (IPCC) assessments and NCAs. The use of terms such as “intermediate” and “very high” to characterize the RCPs better reflects the likelihood of these radiative forcing scenarios happening and makes these scenarios more accessible to general audiences. Consistent use of these more accessible terms beyond the introductory chapters would more clearly and effectively communicate the implications of each scenario throughout the report.

ADDRESSING THE MANDATE IN THE GLOBAL CHANGE RESEARCH ACT OF 1990

Overall, the Committee finds the draft NCA5 report addresses the mandate of Section 106 of the Global Change Research Act (GCRA) (Box 2-1). The draft NCA5 report integrates, evaluates, and interprets the science on climate change, and the Committee finds that the breadth of coverage of key climate change topics is impressive. The draft NCA5 report has done a masterful job pulling diverse information on the complex topic of global change together. In subsequent sections and in Chapter 3 of this report, the Committee offers specific comments on how the information base is interpreted and opportunities for improvement.

BOX 2-1

Global Change Research Act of 1990,^a Section 106. Scientific Assessment

On a periodic basis (not less frequently than every 4 years), the Council, through the Committee, shall prepare and submit to the President and the Congress an assessment which:

1. Integrates, evaluates, and interprets the findings of the Program and discusses the scientific uncertainties associated with such findings.
2. Analyzes the effects of global change on the natural environment, agriculture, energy production and use, land and water resources, transportation, human health and welfare, human social systems, and biological diversity.
3. Analyzes current trends in global change, both human-induced and natural, and projects major trends for the subsequent 25 to 100 years.

^a US Global Change Research Act of 1990, P.L. 101-606 (11/16/90), 104 Stat. 3096-3104.

Regarding subsection 1 of the GCRA, the draft NCA5 report addresses the state of knowledge about the science of climate change, including how climate change is already happening as a result of greenhouse gas (GHG) emissions and how the climate is projected to continue changing; impacts of climate change on sectors and regions of the United States; and how those impacts are projected to change in the future as a result of varying intensities of climate change mitigation and adaptation efforts. Although the Committee has recommendations on how to improve the draft NCA5 report, it is important to note that it is comprehensive, thorough, and well documented. In addition, although the Committee has recommendations on how to better integrate uncertainties into the text supporting key messages, overall, the NCA5

authors have made a substantial effort to assess the state of knowledge and report scientific uncertainties associated with their report findings, providing credibility and transparency to the report.

Consistent with previous NCAs, the draft NCA5 report focuses on climate change and does not focus on other global change issues. In many cases, the draft NCA5 report analyzes the interactions of climate change with other global change issues—particularly how other global changes intensify the effects of climate change. For example, Chapter 6 (Land Cover and Land-Use Change) considers how land cover and land-use change can lower the resilience of ecosystems and agriculture to climate change impacts. Chapter 8 (Ecosystems, Ecosystem Services, and Biodiversity) effectively discusses the interactions of climate change with non-climate stressors including land-use change, urbanization, pollution, and overharvesting, and Chapter 7 (Forests) discusses the impact of fire and land-use change on the terrestrial carbon sink. Additionally, some regional chapters discuss other changes that have important implications for local vulnerability. Chapter 29 (Alaska) touches on non-climate stressors, including food insecurity, limited employment, and cost of living (Key Message 29.7), and Chapter 22 (Southeast) discusses urbanization in the region and how it changes exposure to climate change. However, important global change trends are not discussed in other regional and national chapters. The Focus on Compound and Complex Events defines “complex events” as those where climatic and non-climatic stressors interact in ways that exacerbate climate hazards, but these events are not addressed throughout the Focus. Other changes, such as baseline conditions, may also be important to discuss to better understand how the vulnerability of regions and sectors are changing. For example, the state of the public health system is a key factor affecting the vulnerability of the health sector to climate change but is not discussed in Chapter 15 (Human Health). Overall, the draft NCA5 report could more intentionally integrate how climate change interacts with the full suite of global changes and non-climate stressors.

The draft NCA5 report covers all of the topics enumerated in subsection 2 of the GCRA, including individual chapters on climate change impacts on natural ecosystems and biological diversity (Chapter 8 [Ecosystems, Ecosystem Services, and Biodiversity]), agriculture (Chapter 11 [Agriculture, Food Systems, and Rural Communities]), energy production and use (Chapter 5 [Energy Supply, Delivery, and Demand]), land-use (Chapter 6 [Land Cover and Land-Use Change]), water resources (Chapter 4 [Water]), transportation (Chapter 13 [Transportation]), human health (Chapter 15 [Human Health]), and social systems (Chapter 20 [Social Systems and Justice]), and many other chapters including the regional chapters touch on these issues as well. Several chapters are highly relevant to the scope of the GCRA, though not enumerated in subsection 2, including Chapter 7 (Forests), Chapter 12 (Built Environment, Urban Systems, and Cities), and Chapter 17 (Climate Effects on US International Interests).

Even though NCA5 has a chapter on climate trends (Chapter 2), projections of impacts 25 years to 100 years into the future—as noted in subsection 3 of the GCRA—are not consistently provided throughout the draft NCA5 report. For example, Chapter 15 (Human Health) says little about the projected impacts of climate change on human health. There is some discussion of projected impacts by mid-century and end of the century in most national and regional chapters. However, the Committee did not note any projections or discussions of impacts 100 years from the present (i.e., 2025), though this is likely due to the focus on estimating impacts out to the end of the 21st century in the scientific literature. This has been the case for decades (e.g., National Assessment Synthesis Team, 2001), but as time has passed, the end of the century is less than 100 years after the publication of NCAs, and therefore does not

satisfy subsection 3 of the GCRA. As described in the Committee’s review of Appendix 3 and in Recommendation 8 below, there are difficulties in extending projections beyond 2100, but where this information is available, it should be included. Where there are gaps in the literature in which projections 100 years in the future have not been considered, these gaps should be noted in the “Major Uncertainties and Research Gaps” section of individual chapter traceable accounts.

Some chapters (e.g., Chapter 15 [Human Health]) present future impacts and risks as a function of global warming levels rather than tying them to specific emission scenarios and time frames; both can be effective ways to communicate projections and vulnerabilities into the future. For example, Figure 4.7 in Chapter 4 (Water) displays projected mid-21st century changes in runoff under the “intermediate” emissions scenario, while Figure 8.3 in Chapter 8 (Ecosystems, Ecosystem Services, and Biodiversity), identifies increases in global mean temperature that could lead to a suite of adverse global ecological impacts. Chapters could more consistently discuss first the diagnostic state of the science on impacts (i.e., past and current, including attribution of impacts to climate change) and then the forward-looking prognostic state of science on future impacts, rather than frequently switching between discussions of historical and projected changes.

RECOMMENDATIONS FOR CONSISTENT STRUCTURES

Clear and consistent structures support NCA5 in reaching its target audiences effectively, thereby enhancing the credibility and usability of the report. In the section that follows, the Committee outlines recommendations that address the structure of chapters across the entire draft NCA5 report. Overall, the Committee recommends that consistent structures be followed for key messages, traceable accounts, chapter introductions, and figures. These recommendations considered together would improve the readability of the draft NCA5 report for the range of audiences described in Chapter 1 of this report. Additionally, this section notes a number of content inconsistencies across chapters and provides recommendations for remedies.

Key Messages

Key messages form the backbone of NCA5 and should capture the state of knowledge around climate change and identify important research gaps and possible next steps for advancing the knowledge base. Therefore, it is vital that key messages throughout the report are crafted consistently and carefully. Key messages provide an opportunity for NCA5 to provide credible, salient, and tailored information to audiences in ways that are not policy prescriptive (Farrell and Jäger, 2006). While challenging to write, key messages should incorporate and express the knowledge base through the use of appropriate confidence and likelihood levels and careful writing of findings that can be understood by broad audiences and not taken out of context. As they are currently written, there is significant variation in the structure of the key messages throughout the draft NCA5 report. NCA5 authors may consider the key messages as having three parts: the label (i.e., Key Message 2.1); title (i.e., Climate Is Changing and Scientists Understand Why); and message (see Box 2-2).

BOX 2-2**Anatomy of the Fifth National Climate Assessment (NCA5) Key Message**

This box shows an example key message from Chapter 5 (Energy Supply, Delivery, and Demand) of the draft NCA5 report to illustrate the different components of an effective key message. Colors indicate different components of the key message and the terminology the Committee will use to discuss how to improve the format and content of the key messages throughout this report.

Key Message 5.2. Compounding Factors Affect Energy System and Community Vulnerabilities
Interconnected effects of changes in technologies, policies, and markets increase the potential vulnerabilities of energy systems and communities to climate change and extreme weather (*likely, high confidence*). Compounding and cascading hazards related to energy systems and additional stressors such as cyberthreats and pandemics create risks for all but disproportionately affect underserved and overburdened communities (*likely, high confidence*).

Expanded mitigation and adaptation activities for energy systems include upgraded grid design, hardening of energy infrastructure, and vegetation management to reduce wildfire risk (Moreno et al. 2022; Vazquez et al. 2022) ...

Orange = label

Green = title

Blue = key message

Purple = confidence/likelihood rating

Red = supporting text

Recommendation 1: Key message “labels” and “titles” should follow a common structure throughout the report.

Key message titles should communicate enough information to engage readers and use a consistent hierarchy for the information presented, following best practices in design (Seddon and Waterhouse, 2009). Therefore, the titles would be more effective if written as short, informative statements—instead of just one or two words—that convey a simplified but accurate message. Key message titles in Chapter 5 (Energy Supply, Delivery, and Demand) all convey information—for example, Key Message 5.2, “Compounding Factors Affect Energy System and Community Vulnerabilities.” In contrast, in Chapter 17 (Climate Effects on US International Interests), the title of Key Message 17.2 could be rephrased from “National Security” to “Destabilization of Other Countries by Climate Change Affects US National Security.” Additionally, the Committee appreciates that authors include the words “Key Message” in each label to cue to audiences of what they are reading and its importance. If the authors write titles as brief statements, they should be carefully written to be consistent with the knowledge base in the key message and traceable accounts. The Committee provides more specific suggestions for many of the key message titles in Chapter 3 of this report.

Recommendation 2: The “message” part of each key message should have a consistent reading level, length, and voice throughout the report.

The message part of each key message (see Box 2-2) varies significantly across the draft NCA5 report. The messages are the text that will be read and quoted the most by a wide range of audiences, including those that lack familiarity with the jargon and technical language of climate change; thus, the messages should be the most accessible parts of the report. Each message should be written simply and clearly, using short, uncomplicated sentences, omitting as much specialized jargon or needlessly complex language as possible (e.g., choose a word like “use” over “utilize”) (Somerville and Hassol, 2011; van der Linden et al., 2015). This practice will ensure comprehension by broad audiences. It is similarly recommended by major medical associations that health communication materials target their intended audiences and use appropriate language for broad comprehension (Badarudeen and Subharwal, 2010). The messages also vary in length, ranging from one sentence to more than five sentences. The NCA5 authors may consider selecting a range for a number of words or sentences to standardize key messages so that they are a consistent length. Because of the web-first format, the authors could consider consulting with designers on the best length.

The messages would be more effectively communicated if they were more balanced; some are very broad, and some are very specific. On the one hand, broad messages can seem unclear or not specific enough (e.g., Key Message 4.1, 15.3, 17.1, 18.1, 21.1, 25.4, 28.1). For example, Key Message 28.2 includes “disproportionate” with no explanation of its meaning in the context of the key message. On the other hand, specific messages often have too much jargon and technical language. For example, Key Message 6.3 uses technical phrases such as “crop yield improvements,” “animal-sourced foods,” “agriculture system resilience,” and “biomass crop cultivation” that could be simplified to language that could be more easily understood by general audiences (Somerville and Hassol, 2011). Key Message 28.4¹ is an example of a key message that says a lot but successfully uses plain language. The authors should also carefully consider the use of terms that can be imprecise, such as “historically,” “already,” and “currently,” ensuring that they are used in consistent, accurate ways across key messages. Many language issues occur across multiple chapters, and NCA5 authors may find it useful to look at the full list of key messages together to ensure that terms are being used harmoniously.

When possible, messages and titles should use the active voice (i.e., subject followed by a verb followed by the object of the verb) over the passive voice (i.e., object followed by a verb with or without a subject). Passive voice can be hard for a reader to understand because there is a less clear relationship between the subject and verb, making the relationship between the confidence/likelihood rating and climate impact unclear.² For example, in Chapter 1 (Overview), the section 1.5 header, “Deep cuts in emissions would be required to meet national commitments” could be re-phrased to demonstrate who or what is making deep cuts in emissions

¹ Key Message 28.4. Demographics and Human Health. Increases in extreme heat, drought, and wildfire activity are negatively impacting the physical health Southwest residents (*high confidence*). Climate change is also shaping the demographics of the region by spurring the migration of people, primarily from Central America to the Southwest (*medium confidence*). Individuals particularly vulnerable to increasing climate change impacts include the elderly, outdoor workers, and people with low income (*high confidence*). Local, state, and federal adaptation initiatives are working to respond to these climatic and demographic changes and help people and communities become more resilient (*medium confidence*).

² See https://owl.purdue.edu/owl/general_writing/academic_writing/active_and_passive_voice/active_versus_passive_voice.html.

using active voice. For example, the section header could be revised to: “Local, state, federal, tribal, and Indigenous communities are pursuing mitigation actions that reduce emissions across the country.” However, in using an active voice, NCA5 authors should be careful not to make statements policy prescriptive.

Additionally, some messages use a first-person voice (e.g., “Our Future,” Key Message 29.7; “We Know How to Drastically Reduce Emissions,” Key Message 32.2). In writing, the first-person point of view is used to tell a story from the author’s perspective. Because this is an assessment and review of the state of knowledge rather than original research where the authors could use the first-person to explain their results (i.e., “our findings suggest”), the Committee suggests NCA5 authors avoid first-person language. The Committee also encourages authors to avoid first-person language because it is unclear who the “our” or “we” refers to. It is also important to carefully replace first person language when rewriting these statements rather than simply using encompassing phrases such as “people in the US,” because that can also be inaccurate. Instead of using first-person language, where social science is available to support the key message, references to specific groups of people may be an acceptable replacement. Otherwise, the authors may consider selecting a more generic term such as “people” or “Americans,” but this should be defined in the beginning of the report (i.e., Americans could reference anyone living in the United States or may only refer to citizens, problematically excluding some people who also live in the United States but who are not citizens, such as undocumented immigrants).

Additionally, authors should pay special attention to statements that may be perceived as policy prescriptive or advocating for a specific position, such as declarative statements that may not be adequately supported. In general, evidence that is policy relevant should be emphasized and statements that are normative should be deemphasized. For example, in Chapter 2 (Climate Trends), a subsection in Key Message 2.3 is titled, “The Nation Has No Choice But to Adapt to a Changing Climate” and Key Message 31.3 states “To minimize the potential for adaptation actions to benefit some at the expense of others, adaptation processes must emphasize collaboration, centralize equity and justice, and incorporate a wide range of values and knowledge sources.” These statements should be rephrased so as not to be perceived as recommending certain policies or conveying a level of certainty not reflective of US policy. For example, the subsection in Chapter 2 (Climate Trends) could be re-phrased: “Adaptation can offset the adverse effects of climate change.”

Regarding the text supporting the key messages, the key message should drive the supporting discussion, not the other way around. Many key messages read as though they were distilled after the supporting text was drafted. Instead, the key message should include the key points that reflect the most important or new findings for each chapter. The supporting text should support the entire key message, including providing context and noting uncertainties, as appropriate, that can be elaborated on in the traceable accounts. Attention is needed to ensure text supporting the key messages adequately achieves these goals consistently across NCA5.

Recommendation 3: Confidence and likelihood statements should be used consistently for each claim across all key messages, and readers should be able to readily understand what is meant by confidence and likelihood.

Confidence and likelihood statements convey important context to readers about the claim being made. Confidence is intended to be a *qualitative* statement based on the amount and

consistency of information available (i.e., the weight of evidence). Likelihood is intended to be a *quantitative* statement based on observations and model projections or an assessment of such *quantitative* information across sources (i.e., the probability that an impact has happened, is happening, or will happen). It is often unclear whether the NCA5 authors distinguish between the qualitative versus quantitative natures of the two types of assessments.

In general, confidence and likelihood definitions should be provided for general audiences in the Front Matter, in both written and numerical format (Budescu et al., 2014) and consistently assigned in each key message across NCA5. Each claim in the key message should include confidence at minimum and likelihood if—and only if—a quantitative assessment of probability can be made from the source material. Presently, some messages make multiple claims, but do not include confidence and likelihood at all or only include one statement of confidence/likelihood at the end of the message. This leaves the reader to wonder if the rating is applied to one claim, all claims, or just the most recent claim in the message. The draft NCA5 report in general seldom includes likelihood statements—these should be consistently considered across the document so that the lack of likelihood statements reflects the threshold defined in the Front Matter rather than an oversight. Box 2-3 provides an example of a successful use of confidence/likelihood statements and an example of a key message where the use of confidence/likelihood statements could be improved.

Additionally, likelihood statements are often provided without a corresponding explanation of quantitative support in traceable accounts sections. The likelihood statements correspond to specific probability ranges per the definitions provided in the Front Matter, which require care to justify the difference between levels of likelihood (e.g., *very likely* at >90% probability versus *likely* at >66% probability). Expert judgment can be part of the likelihood assessment, but the assessment should be based on more than belief, and the basis for such quantitative judgments should be adequately described in the traceable accounts. When quantitative likelihood assessment is not possible, it is preferable to provide only a confidence statement consistent with the knowledge base. In some cases, the knowledge base is limited or emerging, and this should be reflected in the confidence language and further expounded on in the traceable accounts. Because general audiences may only read the main text and not the more technical traceable accounts, it may also be appropriate to highlight key uncertainties briefly in the text supporting the key messages. Specifically, providing uncertainty or knowledge gaps with scientific claims makes the information more useful to decision makers and increases transparency, which can contribute to trustworthiness.

In some cases, the draft NCA5 report ascribes likelihood language to findings that are not in dispute (i.e., where the likelihood probability, based on the knowledge base, is greater than 99%). In such cases, the Committee suggests NCA5 authors follow the IPCC Sixth Assessment Report (AR6) language to classify these findings as “unequivocal” or “established fact” rather than “very high confidence.” For example, Key Message 2.1 states, “It is virtually certain that human activities have increased atmospheric levels of carbon dioxide and other greenhouse gases (*very high confidence*)” whereas IPCC AR6 states: “Observed increases in well-mixed greenhouse gas (GHG) concentrations since around 1750 are unequivocally caused by human activities” (IPCC, 2021a). The use of term “unequivocal” is appropriate when discussing facts where there is no doubt regarding the findings.

The language that scientists use to describe uncertainty, including the words “confidence” and “likelihood,” is jargon. It is the specialized language of science and the words confidence and likelihood have different meanings and interpretations in everyday use (Somerville and

BOX 2-3**Example Confidence and Likelihood Statements from Key Messages**

Good Example: Each claim includes an associated confidence/likelihood statement:

The Northern Great Plains is experiencing unprecedented extremes related to changes in climate, including severe droughts (*likely, high confidence*), increases in hail frequency and size (*medium confidence*), floods (*very likely, high confidence*), and wildfire (*likely, high confidence*), with alterations in plant community and crop growth (*very likely, very high confidence*). (Key Message 25.1)

Needs Improvement: Multiple claims are listed in the first sentence, but there is no confidence/likelihood associated with the claims. The reader is left to determine if *Very Likely, Very High Confidence* relates to all claims in the key message or only the last claim:

Climate change is already harming human physical, mental, and spiritual health through increasing frequency and intensity of extreme events, increasing cases of infectious and vector-borne diseases, and declines in food and water security. Climate-related hazards will continue to grow, increasing morbidity and mortality across all regions of the United States. (*Very Likely, Very High Confidence*) (Key Message 15.1)

Hassol, 2011). In the Front Matter, the concepts of confidence and likelihood could be expanded somewhat to make them more accessible to readers unfamiliar with this language based on results from Budescu et al. (2014). The authors may also consider including a visual representation of confidence and likelihood, to supplement the text and numerical definitions in the Front Matter (Kause et al., 2022; Mastrandrea et al., 2010). The IPCC report is a similarly technical report, so simply presenting these terms and definitions with reference to the IPCC report is insufficient. Authors may consider a brief explanation about the nature of science, and how a single study or finding may advance understandings, that repeated replications of that work, scrutiny by the community of experts, and the convergence of expert agreement of particular findings and claims increase confidence in those understandings (Oreskes, 2021). This need not be extensive because that work has been done elsewhere, but this brief context is important for a less technical reader. In the web design, NCA5 authors may consider including definitions of confidence or likelihood ratings when the mouse arrow hovers over the phrase to remind readers of the meaning of these terms or navigate back to the Front Matter. Additionally, authors may consider including the standard definitions of confidence and likelihood at the beginning of each chapter as a standalone section. Many readers may never read the Front Matter where these terms are defined.

Traceable Accounts

Recommendation 4: A consistent framework for traceable accounts sections would better support the key messages and build consistency and credibility across chapters.

Traceable accounts written for each key message are an essential component of NCA5, providing both credibility and transparency to each key message and associated text and, therefore, the report. Overall, the traceable accounts include information about the state of knowledge and uncertainties that strengthen the quality of NCA5. The Committee's review of the traceable accounts emphasized, to the extent possible, whether the evidence presented for each key message consistently and adequately supported the assigned confidence and likelihood designations and the associated text rather than rigorously assessing the credibility of the determinations made by the authors. The Committee commends the use of confidence and likelihood statements consistent with the IPCC Fifth Assessment Report (AR5) definitions; however, there are significant inconsistencies in the traceable accounts sections across chapters, both in structure and how the evidence is presented. Chapter-specific comments are presented in Chapter 3 of this report, but here the Committee notes some of the major inconsistencies and provides recommendations to build a framework for NCA5 authors as they revise the traceable accounts sections.

Overall, the traceable accounts are appropriately written at a more technical level than the rest of the report and summarily discuss the literature base for their key messages. However, traceable accounts sections inconsistently satisfy their intended purpose, as defined by USGCRP (2018a): to detail *how* the authors arrived at their confidence and likelihood statements, and *what* evidence was used. The process for writing the traceable accounts is an analytical one about the state of the science in which authors should apply robust evidence (i.e., literature cited) to justify both the confidence and *likelihood* assigned to each statement within each key message. Thus, within the traceable accounts section, broad statements about the literature do not suffice and should be removed, citations should be included, and the substantive scope of the traceable accounts should be limited to the scope of the main text of the chapter. Additionally, where in the supporting text, authors are only able to make brief statements with a citation due to chapter word limits, they may provide greater depth in the traceable accounts, expanding on the main text to include additional context and discussion, specifically describing how that detail, nuance, or gap in understanding factored into the confidence and likelihood rating. For example, a discussion of which projections were and were not available for the chapter authors to consider and an explanation of model uncertainties are appropriate to include in the traceable accounts. There are many dense and technical passages in the text supporting the key messages that may be better suited for traceable accounts sections to enhance the readability of the main text (e.g., the text describing advances in the understanding of equilibrium climate sensitivity in Chapter 3 [Earth System Processes], pages 3-9 to 3-10).

There are many instances across the draft NCA5 report where traceable accounts sections do not provide any citations to support their statements (e.g., Chapters 4 [Water], 21 [Northeast], and 23 [US Caribbean]) and/or use broad statements such as “authors used their collective expertise and weighed the overall literature” to reach conclusions (e.g., Chapters 17 [Climate Effects on US International Interests], 23 [US Caribbean], and 25 [Northern Great Plains]). This kind of broad statement is descriptive of the process used to synthesize the literature and is not a substitute for identifying the literature (and should, likewise, be removed), nor does it provide sufficient detail required or support for the key messages. Section 106 of the GCRA does not require a summary report of the authors' collective expertise but rather an integration, evaluation, and assessment of the credible scientific base. It is appropriate for process details to be included; however, this should be done in a consistent way (e.g., some chapters provide a list of authors' expertise while others do not). Traceable accounts sections should be revised to

demonstrate *which* references support *each* confidence and likelihood statement under each key message. Examples of thoroughly written traceable accounts can be found in Chapter 5 of the Climate and Health Assessment, Vector-Borne Diseases (Beard et al., 2016) or the Energy Chapter of the Fourth National Climate Assessment (NCA4) (USGCRP, 2018a). In the draft NCA5 report, the traceable accounts for Chapter 19 (Economics) are strong overall, though there is room for improvement in the use of citations, described in Chapter 3 of this report.

The Committee recommends the following structure for traceable accounts that could be used throughout NCA5:

- Provide the full key message at the start of each traceable account.
- Summarize *which* references support each confidence and likelihood claim.
 - Include citations in “Description of Evidence Base.”
 - Include citations to “Major Uncertainties and Research Gaps.”
- Include a “therefore” statement describing *why* authors designated confidence and likelihood findings. Authors should describe *why* the confidence is not lessened due to research gaps *and* cite literature that supports this decision *only* if that literature is cited in the main text.
 - Include citations to “Description of Confidence and Likelihood,” if relevant.

Chapter Introductions

Recommendation 5: The introduction to each chapter should be consistent in length, depth of content, relationship to key messages, and voice; new terminology should also be introduced in a consistent manner.

NCA5 authors should assume that readers will read chapters that they are interested in without reading the Front Matter, Chapter 1 (Overview), or other introductory material. In general, the introduction section of the chapter should provide the reader with a brief background and context on the chapter theme and its relevance to climate change, a brief statement about what was covered in NCA4 and what new knowledge is being added in NCA5—including the key messages—and what the chapter will not cover. While it is appropriate for the text supporting the key messages to look different from one chapter to another, consistent introductory sections would provide readers with the appropriate context and a roadmap to understand the rest of the chapter. The consistent inclusion of sub-headers throughout chapters could also help to support this goal.

Many of the chapter introductions would benefit from a high-level introductory sentence to explain why climate change is relevant to the chapter’s topic or themes. In most introductory paragraphs, it is not explicit how the introduction section is related to the key messages. In introducing a chapter’s contents, the introduction should not read as an abstract of the chapter (e.g., Chapters 2 [Climate Trends], 4 [Water], and 28 [Southwest]). Chapter authors could consider using a model like Chapter 17 (Climate Effects on US International Interests) where the introduction is directly related to the key messages and key message titles are in parenthesis. Chapter 29 (Alaska) also provides a successful example that includes a table of the key messages with examples of climate drivers/impacts and responses; this type of summary or roadmap could be replicated in other chapters. In addition, chapter introductions should explicitly note what

topics are covered in the chapter and what topics are not. For example, Chapter 19 (Economics) does not discuss the economics of mitigation, and Chapter 17 (Climate Effects on US International Interests) does not review the international impacts of climate change—these choices should be explained in the introductions.

Introductory sections vary widely with respect to the use of technical language and could better engage the target audiences if they were less technical. The Committee highlights chapter-specific instances where jargon is used in Chapter 3 of this report. Similarly, when introducing new or complicated terms, authors should assume readers are encountering them for the first time, including seemingly basic terms (e.g., adaptation, mitigation). For commonly used terms across the whole report, a consistent definition should be selected and used throughout and referenced in the glossary currently under development for the final report but not available in the draft NCA5 report. For example, Chapter 31 (Adaptation) details the choice of “adaptation” over the commonly used “resilience” whereas “resilience” is used in many other chapters. Chapter 20 (Social Systems and Justice) uses “overburdened communities” over other terms frequently used in the report, such as “marginalized” or “underrepresented.” The NCA5 authors should make decisions about commonly used terms and use them consistently throughout the report. In the web design, rollover definitions could be provided for common phrases or words that are defined in the glossary.

The introductions to each chapter also use in-text citations and figures inconsistently. While figures may be more appropriate for some chapter introductions over others, there are opportunities to build consistency—for example, all regional chapters could include a map of the region with place names and locations referenced throughout the chapter. Introductions that use figures could consistently place them at the end of the section rather than in the middle because they are typically short sections. The NCA5 authors may also consider a word range for the introduction sections so that they are all roughly the same length throughout the report. The NCA5 authors should expand upon the glossary definitions in the chapter when the additional context or an expanded definition is needed to present a more precise definition tailored to the chapter readers.

Graphics and Boxes

Recommendation 6: All figures, figure captions, and figure citations should be consistent and self-contained.

Overall, the Committee is impressed with the graphics throughout the draft NCA5 report and understands that many graphics are still being designed or were unavailable to review due to the timing of copyright clearances. As the NCA5 authors make revisions, the Committee suggests they consider that many readers will only look at the figures and read the captions and may download and use the figures for a range of uses (e.g., reports, power points, lectures). Therefore, the Committee recommends making graphics self-contained such that the reader can easily understand the key ideas related to the figure without looking in the text. On the other hand, many figures are not adequately discussed in the body of the chapters and are at most pointed to in a parenthetical or not at all. All figures should be integrated meaningfully into the text to justify their inclusion in the chapter.

Based on recommendations by Gerst et al. (2021), Harold et al. (2016), and Rougier et al. (2014), the Committee encourages authors to ensure that each figure adheres to some basic principles of design and include at a minimum:

- Consistent use of titles;
- Legible text;
- Use of color and contrast, accessible to people who have colorblindness;
- Legend, if applicable;
- Sufficiently detailed caption; and
- Reference to the figure source(s), if applicable

To expand on the checklist above, there are many opportunities to introduce more consistency across the figures throughout the report. Furthermore, Gerst et al. (2021) explains how to improve many NCA figures based on experimental studies. Regarding embedded figure titles, NCA5 authors could consider choosing a consistent format for titles and making sure titles above and embedded in figures match. Regarding the color palette, the NCA5 authors could consider a consistent palette across the report figures, and if possible, use colors consistently to communicate particular ideas (i.e., ensure icons related to water are the same shade of blue). Regarding symbols and icons, NCA5 authors could consider adopting a similar style of icons across the report, and use them consistently (e.g., a fish icon representing fisheries in one figure will be the same fish icon representing fisheries in another graphic) and define these icons using legends in individual figures, where appropriate.

Figure caption length and amount of detail varies greatly across the report. Captions should sufficiently communicate the key ideas in the figure, explaining to the reader the important trends, takeaway points, data sources, or other information to inform readers on how the figure was created and how it should be read (Rougier et al., 2014). Captions should begin with a nontechnical explanation of what the figure shows and then, to a limited extent, the technical underpinnings of the figure. Especially in the case of a schematic illustration—a type of figure that presents a scene or story with text boxes or callouts of important facts—the captions should have sufficient references to the source material used to create the figure (Perra and Brinkman, 2021). Many (e.g., Figures 10.5, 11.5) only list the agencies or organizations that created the data or figure, making it difficult for audiences to identify the source for a claim communicated by, or data used, to generate a figure. In addition, captions should always include dates of the data or information being presented. The web version of the report could use hover-over popups to include more technical underpinnings of the figure.

The draft NCA5 report uses maps throughout to communicate a lot of information. Consistent with the recommendation about icons, the Committee suggests the report use consistent map features (e.g., colors and symbols) so that readers can easily understand any map they see in the report. Special attention is needed to establish a consistent arrangement of the contiguous states, Alaska, Hawai‘i and the US-Affiliated Pacific Islands, and the US Caribbean (Puerto Rico and the US Virgin Islands) on maps to ensure the full geographic domain of NCA5 is depicted. In the draft NCA5 report, Alaska and Hawai‘i are placed on maps in various locations (e.g., sometimes in their geographically accurate locations and sometimes below Florida), and in some cases, are not included at all. The US Caribbean is rarely included. If a geographic region is omitted, there should be an explanation in the caption as to why (e.g., no data). Additionally, there are issues related to scale with Alaska, Hawai‘i, the US-Affiliated

Pacific Islands, and the US Caribbean, and when that is the case, appendixes could be used for maps that are too small or out of scale. Gerst et al. (2021) should also be referenced for guidance on developing maps.

Recommendation 7: Boxes within chapters should be used to highlight specific examples or to summarize or improve message accessibility.

The use and content of boxes in chapters varies considerably across the draft NCA5 report. Boxes could be more effective if reserved for specific types of content (e.g., firsthand stories, examples, complex concepts, an important figure, or to summarize or otherwise improve message accessibility) in order to highlight specific items and/or deliver content more rapidly. Assessments of this nature inevitably provide a high-level summary of the state of the science, which can be rather abstract. Boxes are an opportunity to provide specific examples that can help readers connect the material to their everyday lives or policies and decisions they may hear about on the news, thus reducing the psychological distance (van der Linden et al., 2015). At the same time, boxes should at least mention their connection to climate change and related discussions in the chapters—for example, Boxes 28.2 and 4.3 do not mention the role of climate change.

When possible, boxes could be better utilized to communicate a message that is not clearly expressed in the main text or needs amplification. Boxes should include the relevant who, what, when, where, why, and how to provide a more tangible connection for readers. For example, Boxes 14.1 and 18.1 both tell compelling stories with data. Chapter 29 (Alaska) has many boxes with firsthand accounts from residents, which are excellent for making abstract phenomena more concrete and integrating Indigenous knowledge, but could be enhanced with some additional information (i.e., a description or graph showing the climate trend) and context (i.e., a few introductory sentences to describe the setting).

ADDITIONAL INCONSISTENCIES BETWEEN CHAPTERS

In addition to the structural issues raised above, there are a number of other inconsistencies across the draft NCA5 report that pertain to the ways topics and terms are structured and discussed. As a web-first report, it is unlikely NCA5 will be read by audiences cover-to-cover; thus, it is appropriate for chapter authors to design their chapters to meet their specific topical needs. However, there are certain content areas, described below, that would benefit from more consistent treatment throughout the draft NCA5 report to strengthen the credibility of key messages and enhance clarity and readability. Where inconsistencies in structure and content between chapters cannot otherwise be resolved, the Front Matter could explain these differences (e.g., the structure of each chapter was decided by the chapter authors). In the section below, the Committee outlines specific inconsistencies that stood out and, if resolved, would improve the draft NCA5 report.

Recommendation 8: The draft NCA5 report should be revised to address inconsistencies across chapters, including treatment of adaptation and mitigation, distinction between natural variability and climate change, use of scenarios, treatment of Focus On... Features, and the use of terminology.

Treatment of Adaptation and Mitigation

Adaptation and mitigation are not treated consistently across chapters. Adaptation is a major topic in all chapters, except in Chapter 32 (Mitigation), but it is not addressed in a consistent manner (e.g., sometimes together with mitigation). For example, in Chapter 7 (Forests), Key Message 7.3 focuses on adaptation, while Chapter 12 (Built Environment, Urban Systems, and Cities) has Key Message 12.3 on mitigation and adaptation measures in the built environment. Both sectors have GHG emissions or removals and are affected by climate change and thus address both mitigation and adaptation. Regional chapters in particular inconsistently include mitigation in key messages. There are also inconsistencies in how the regional chapters describe adaptation efforts or obscure what adaptation means by using examples such as forest management. Some chapters, such as Chapters 21 (Northeast) and 25 (Northern Great Plains), have key messages on adaptation, while most other regional chapters discuss adaptation within sectors and themes. Mitigation is sometimes mentioned together with adaptation, but examples used are typically only related to adaptation (e.g., Chapters 15 [Human Health], 21 [Northeast]). Often, chapter key messages include adaptation but omit discussions of mitigation entirely (e.g., Chapters 25 [Northern Great Plains], 16 [Tribes and Indigenous Peoples]).

In addition to emphasizing mitigation more prominently, GHG emissions and removals should be described in a consistent way across the report. Specifically, total emissions and net-zero emissions are often blurred together, as are removals and carbon sequestration (e.g., Figure 32.1 in Chapter 32 [Mitigation]). Furthermore, Figure 32.1. is confusing in this regard. The historical record is shown as gross emissions, with net-zero in 2050 shown as these emissions trending to zero emissions. Should the forest sink be included and continued, 2050 would be net negative, while “net-zero” would be reached around 2040. The statement that forests are a sink of 0.8 is not consistent with Chapter 7 (Forests), which reports the sink as 0.4. This confusion extends from what appears to be the absence of a standard inventory of emissions and removals across the entirety of the report. For example, NCA5 authors could select a consistent US emissions dataset and time frame based on the latest EPA national GHG inventory for 1990-2020 (EPA, 2022) with a standard benchmark year. Likewise, “key categories” should consistently refer to the chosen dataset. Such a dataset should be introduced to the reader (e.g., in the Front Matter or Chapter 2 [Climate Trends]), including appropriate caveats and limitations, and consistently cross-referenced throughout.

A key area of advancement since NCA4 is in negative emission technologies (e.g., carbon dioxide removal). Relevant to the discussions of adaptation and mitigation, these technologies should also be discussed as part of the broader portfolio of options to achieve net-zero GHG emissions, including relevant references (e.g., NASEM, 2019, 2021, 2022a).

Distinction Between Natural Variability and Climate Change

The draft NCA5 report frequently describes “change” but does not consistently distinguish between natural variability and climate change. This lack of clarity can be misleading for the reader by creating the misconception that some impacts that are the result of the combination of natural variability and climate change are instead solely due to climate change (e.g., Chapters 4 [Water], 6 [Land Cover and Land-Use Change], 9 [Coastal Effects], 28 [Southwest], 30 [Hawai‘i and US-Affiliated Pacific Islands]). Consistent with the mandate of the

GCRA, it is important for NCA5 authors to accurately identify the multiple drivers of change (including global change), in addition to climate change, and accurately attribute impacts. Clearly describing impacts due to natural variability, climate change, or a combination of the two is important not only for informing policy decisions, but also for building public understanding and trust in the report's messages. Climate change and natural variability should be clearly defined in the glossary and natural variability could be introduced in chapter introductions when the concept is important for understanding key messages.

Use of Scenarios

Where projections from multiple climate change scenarios are available, (e.g., RCPs 4.5 and 8.5), NCA5 should strive to report results from multiple scenarios. This is particularly important because the divergence between projected climate impacts based on different scenarios becomes more pronounced decades from now, especially after mid-century. Projections of sea-level rise from different climate models should also be included when such results are available. Specifically, regional chapters should utilize results from multiple emission scenarios (e.g., RCPs), sea-level rise scenarios, and climate models where such results are available. The Committee recognizes that many studies of climate change impacts only use the “Very High Scenario” (RCP 8.5). In such cases, only the projections from that scenario can be reported in NCA5, but the limited use of emissions or sea-level rise scenarios and climate models should be clearly reflected in confidence and likelihood levels and explained in the traceable accounts. Findings based on a single scenario and one or a few models should, all else being equal, receive lower confidence and likelihood than findings based on the application of multiple scenarios and models.

Data, models, and projections used to formulate likelihood statements should be standardized across the chapters. Appendix 3 describes the standard datasets provided to the NCA5 authors: downscaled model-based projections of temperature and precipitation and sea-level rise scenarios. However, the individual chapters deviate from these standard datasets in many cases, drawing from a variety of sources, including local assessments and past NCAs. Each chapter should, at minimum, provide statements based on the standard sources meant to be common across NCA5. If other sources provide different or more nuanced information then these sources can be utilized as well—but always as a supplement to the standard sources in Appendix 3, not in place of the standard sources.

Treatment of Focus On... Features

The Focus On... Features are topics chosen because of their cross-cutting importance but could be better integrated into the national and regional chapters. These features address interesting topics, and the Committee applauds their inclusion in the draft NCA5 report. However, they are only mentioned in passing in some relevant chapters (e.g., Focus on Western Wildfire in Chapter 7 [Forests], Focus on Risks to Supply Chains in Chapter 19 [Economics]). More importantly, the relevant chapters do not substantively integrate the Focus On... Features (e.g., Chapter 16 [Tribes and Indigenous Peoples] discusses COVID-19 and does not cite to the Focus on COVID-19 and Climate Change; Chapter 8 [Ecosystems, Ecosystem Services, and

Biodiversity] discusses wildfires but does not cite the Focus On Western Wildfires; Chapter 18 [Sector Interactions, Multiple Stressors, and Complex Systems] does not mention the Focus on Compound and Complex Events), and there are opportunities to use these features to reduce redundancies and point the reader to sections, and vice versa, with more detail. For example, Chapter 30 (Hawai‘i and US-Affiliated Pacific Islands) contains an entire box on Blue Carbon Ecosystems (Box 30.4). The chapter may more effectively reference the Focus on Blue Carbon and devote that box space to another relevant example.

Additionally, the Focus On... Features should reflect a structure similar to that of the national and regional chapters to effectively communicate the chosen topics. The bolded statements in each Focus On... Feature should be treated as key messages, be clearly and carefully written in concise, accurate sentences, and they should include confidence and likelihood statements. The traceable accounts should include a brief discussion of authorship, discuss the knowledge base, include references, and detail the rationale for confidence and likelihood statements, in line with the recommendations on traceable accounts above.

Use of Terminology

In general, careful attention to consistent terminology and precision of language is needed. The draft NCA5 report does not consistently use the metric or Imperial system between and within chapters. Chapter 1 (Overview) introduces the convention of Fahrenheit (Celsius) but does not use this convention consistently, which causes reader confusion. There are even inconsistencies within sentences, for example, in Chapter 2 (Climate Trends): “For every additional 1°C of global warming, the average US temperature is projected to increase by around 2.5°F.” Terminology for similar concepts is also used differently from chapter to chapter—for example, adaptation versus resilience, ocean economy versus marine economy, citizen versus resident, nature-based solutions versus natural climate solutions, carbon sequestration versus carbon removal, and land-use change versus land system change. The Committee acknowledges the challenges in coming to a consensus on acceptable definitions for terms used commonly and interchangeably across scientific disciplines. The Committee suggests defining terms where they are meant to have a distinct meaning in the report text and the glossary currently under development (e.g., explain the difference between carbon dioxide removal, carbon sequestration, and carbon capture use and sequestration/storage) and consistently use one of the terms (e.g., use adaptation instead of resilience) across the report where multiple terms convey the same meaning. Throughout the report, imprecise language is also frequently used—for example, “significantly,” “will,” and “driving.” This language makes assumptions about decision making, and in some cases, may suggest levels of scientific confidence that are not supported by the text, citations, and traceable accounts.

Recommendation 9: The draft NCA5 report should be revised to utilize and distinguish between the different use cases of sea-level rise projections and sea-level rise scenarios clearly and consistently.

Projected sea-level rise (SLR) is not treated consistently across national and regional chapters and is often inconsistent with confidence and likelihood levels defined in the Front Matter. Some regional chapters (e.g., Chapter 22 [Southeast]) utilize only discrete SLR scenarios

from the Sea-Level Rise Technical Report (Sweet et al., 2022), while others use projections from emissions scenarios in IPCC AR6 (e.g., Chapter 23 [US Caribbean]), and still others attempt to relate the two but do so incorrectly (e.g., Chapter 30 [Hawai‘i and US-Affiliated Pacific Islands], 28 [Southwest], 27 [Northwest]). An underlying cause of this inconsistency is the overlapping naming conventions between the SLR and emissions scenarios. For example, the Intermediate Scenario for SLR from Sweet et al. (2022) most closely corresponds to IPCC SSP5-8.5, which is the Very High Emissions Scenario, while the Intermediate Emissions Scenario corresponds to IPCC SSP2-4.5. Additional confusion arises from the discrete nature of the SLR scenarios, which contrasts with the ensemble-based IPCC projections used for all other climate indicators; misunderstanding these differences leads to inaccurate and poorly formed likelihood statements that cannot be appropriately derived from a discrete trajectory.

In general, NCA5 should utilize and distinguish between the different use cases of SLR projections versus SLR scenarios. Projections offer information about the range of possible SLR outcomes for a specific emissions scenario, while the scenarios provide a range of discrete decision-relevant timelines for the purpose of developing adaptation approaches. It is not good practice—nor is it necessary—to utilize only one type of SLR information to satisfy the dual needs of making likelihood statements and providing decision-relevant information. The Committee suggests two possible ways the draft NCA5 report can be improved in this regard. The first (and preferred) option is to standardize the use of the ensemble-based IPCC SLR projections to make likelihood statements—similar to how temperature and precipitation are handled—and to standardize the use of the Sweet et al. (2022) scenarios for use in discussing decision-relevant timelines. In this case, statements such as the one made on Page 9-20 Lines 7-8 would be formulated similar to those in IPCC AR6 Chapter 9—for example, “Considering only processes for which projections can be made with at least medium confidence, global mean sea-level will increase from 2020 to 2050 by Y [X to Z, likely range] meters for SSP1-1.9 and by B [A to C, likely range] meters for SSP5-8.5.” The second option is for NCA5 authors to narrowly focus on the Sweet et al. (2022) scenarios. In this case, clear guidance should be provided to chapter authors for how to formulate reasonable likelihood statements around these discrete timelines. One way to do this is to emphasize the use of Table 2.4 in Sweet et al. (2022), whereby a possible likelihood statement made using the scenarios in combination with NCA5 confidence/likelihood language could be, “The Intermediate SLR Scenario is *unlikely* to be exceeded for 3°C of global average surface warming by 2100 and is *about as likely as not* to be exceeded under Very High Emissions (SSP5-8.5) when including Low-Confidence Processes.” Regardless of which of the above options is chosen, Appendix 3 detailing the relationship between IPCC projections and the Sweet et al. (2022) SLR scenarios should be expanded as it does not adequately explain the relationship, nor does it adequately detail the difference between the framing and appropriate use cases of each source of information. Additional comments regarding the handling of SLR projections and scenarios are provided in Chapter 3 of this report.

Recommendation 10: Individual chapters across the draft NCA5 report—particularly national and regional chapters—should be better integrated and cross-referenced.

The structure of the draft NCA5 report begins with the physical science chapters (Chapters 2-3) that provide a foundation for the national chapters (Chapters 4-20), which support the regional (Chapters 21-30) and responses chapters (Chapters 31 and 32). The national chapters lay out foundational concepts and the regional chapters build on that information to explore

specific regional impacts. Better integration of sector and regional chapters would lead to a more coherent NCA5 that more clearly highlights the integrated complexities associated with climate change.

The national chapters appropriately cover issues at the scale of the United States. Some regional chapters raise topics that are not necessarily specific to that region but could be covered in appropriate national chapters. For example, Key Message 21.5 in Chapter 21 (Northeast) discusses whether finance for climate action plans is adequate. The text in this key message addresses both national and regional concerns, and the matter of adequacy of finance for mitigation and adaptation is certainly not limited to the Northeast region. Rather, this issue is of national importance, and it may be more appropriate to address the adequacy of finance in Chapters 31 (Adaptation) and 32 (Mitigation) and, if appropriate, have the regional chapters cover finance issues specific to the respective regions.

Cross-referencing chapters across the report demonstrates the inherent interconnections and complexities of climate change and its impacts. Overall, stronger cross-referencing between chapters would reduce redundancies and inconsistencies, create more space for authors to expand on certain topics, and strengthen connections between topics. For example, some regional chapters (e.g., Chapter 30 [Hawai‘i and US-Affiliated Pacific Islands]) appear siloed from the rest of the report and would benefit from comprehensive two-way cross-referencing with relevant national chapters. While all chapters may not have been available to authors at the time the draft NCA5 report was developed, there is an opportunity for authors to leverage information included in different chapters as the draft NCA5 report is revised.

Relatedly, regional authors should be mindful when citing studies that cover the nation rather than the region (e.g., Chapter 25 [Northern Great Plains] discussion of mental health) not to create an ecological fallacy when national analyses are downscaled to regions. Similarly, national chapters should be mindful when citing global studies (e.g., Figure 8.3). The NCA5 authors should identify global or national-level studies as such and use appropriate confidence levels when applying results to smaller geographic scales. Each chapter should discuss these limitations in the literature (as mentioned above) in their traceable accounts sections.

RECOMMENDATIONS ON EQUITY AND JUSTICE

Recommendation 11: For consistency, chapter introductions should include context on equity and justice as related to the chapter topic. To move beyond general statements, different dimensions of justice, including distributional, procedural, recognition, and intergenerational justice, should be addressed as appropriate throughout the chapter text. Related gaps in the literature should be identified in the text and traceable accounts.

The Committee commends the NCA5 authors for incorporating equity and justice into the report; however, there are opportunities to highlight related issues more intentionally and consistently across the chapters. Notions of “equity” and “justice,” along with their related dimensions, are critical when considering climate change impacts, mitigation, and adaptation. Acknowledgment emphasizes the rights and interests of populations that have traditionally been excluded due to gender, age, race/ethnicity, poverty, or other social factors, and helps to identify key questions and indicators that can be used to assess progress, issues of access, the distribution of costs and benefits, competing interests, as well as just transitions. Though these and related

terms will take on different meanings depending on the context, they can be applied in an appropriate manner across all chapters for consistency and cohesiveness.

Dimensions to consider include distributional, procedural, and recognition justice, as described in Chapter 1 (Overview) (page 1-40). As the dimensional overview on page 1-40 is critical for consistent integration across the report, the Committee suggests a citation for the definitions provided. In addition, the concept of intergenerational justice should be added. For consistency in term usage, NCA5 authors may reference the definitions in the Chapter 1 (Overview) (page 1-40) or develop and reference a more robust glossary with cited definitions (see Recommendation 12 below). To address different dimensions of justice, authors may highlight how resources, impacts, vulnerabilities, benefits, and burdens vary across populations or geographies; recognize who is typically involved in the decision-making processes; highlight historical norms regarding inclusion and representation; and identify who is typically left out of such processes. “Intergenerational” equity considers fairness or justice between present and future generations, including the burdens and costs that will be incurred by future generations as a result of action taken (or not taken) at present. Issues of access, including appropriate data and governance are also important to consider to support inclusiveness and equity. As climate change impacts, mitigation, and adaptation sometimes expose competing priorities, recognition of trade-offs, including equity and justice concerns, should be addressed when applicable.

Overall, there is substantial variation in how equity and justice issues are integrated across chapters. Some chapters, for example Chapter 9 (Coastal Effects), use the introduction to strongly frame the chapter in the context of equity and justice, while other chapters such as Chapters 6 (Land Cover and Land-Use Change), 7 (Forests), and 8 (Ecosystems, Ecosystem Services, and Biodiversity) make no mention of equity or justice in the introductions. Chapter 15 (Human Health) frames health in the context of equity and justice in the introduction and goes on to consistently integrate related issues throughout the chapter, including systemic connections, depth of reporting on disproportionate impacts (rather than a blanket statement), and related dimensions of equity. Chapter 18 (Sector Interactions, Multiple Stressors, and Complex Systems) strongly illustrates the systemic interconnections relating climate change to equity and justice, and uniquely—but importantly—integrates governance and data justice issues. Other chapters would benefit from following these examples. The Committee recommends including equity and justice framing in chapter introductions and prioritizing the integration of related issues throughout the chapters where possible, rather than stand-alone sections addressing the topic. Doing so would highlight systemic interconnections and help avoid the appearance of addressing the topic as an afterthought. Additional considerations for addressing equity and justice throughout NCA5 are outlined in Box 2-4.

Recommendation 12: A glossary of terms related to equity and justice should be adopted and/or developed to ensure consistent use of terminology across NCA5. Associated references should be provided.

To ensure consistency throughout the report, the Committee recommends the development or adoption of a glossary of terms related to equity and justice. Care should be taken to avoid terminology that is harmful to impacted communities, particularly the use of deficit language. For example, many chapters use the phrase “marginalized communities,” but referring to people as “marginalized” can perpetuate perceptions of inadequacy and lack of autonomy within the communities being discussed. Generally, it is best to be as specific as

BOX 2-4 Equity and Justice Considerations

The following aspects of equity and justice should be considered across all contexts and chapters:

- Who is vulnerable in this context, and why? Be as specific as possible (i.e., historically overburdened communities, geographically vulnerable, occupationally vulnerable, age-related vulnerability, medical vulnerability) and make connections with systemic factors that may lead to, contribute to, or perpetuate vulnerability;
- Intersectionality and its relationship with climate vulnerability, mitigation, and adaptation (Amorim-Maia et al., 2022);
- Questions of “for whom,” “by whom,” “where,” and “how” (which address just transitions and dimensions of equity including distributional, recognitional, procedural, and intergenerational);
- The role of environmental data justice/availability and accessibility to relevant data and information;
- The role of governance, particularly how the integration of local context and perspectives helps to address the different dimensions of equity;
- Knowledge sources outside of peer-reviewed literature, including grey literature, white papers, storytelling, and Indigenous knowledges;
- Name inequity/injustice as such;
- Highlight concerns that have been raised by traditionally underrepresented communities;
- Avoid deficit framing language, emphasize leadership and innovation;
- Recognize social and structural components when considering the compounding/cascading/complex impacts and risks;
- Identify trade-offs as they relate to equity and justice; and
- Present mitigation/adaptation solutions, case studies, and/or stories from diverse geographies, or populations that integrate equity and justice issues.

possible when describing equity-and justice-related issues—including populations—rather than relying on jargon and terms. The Committee recommends following a similar process as was used in the New York State Climate Impact Assessment³ process, in which a glossary of terms related to equity and justice was developed from respected information sources. In the draft NCA5 report, there is inconsistent use of terminology around climate and gentrification (e.g., eco-gentrification, green gentrification, environmental gentrification) and terminology on race and socioeconomic status (e.g., minority, racialized minority, BIPOC, low income, low wealth). For example, Chapter 15 (Human Health) uses both “low-income” and “low-wealth,” while most of the other chapters use “low-income.” These two terms are distinct and should be used appropriately based on the intended meaning. Agreement on one respected reference for each term, such as “low-income” and “low-wealth,” would help to ensure consistent use of terminology across the report.

Recommendation 13: To provide equitable access to climate-related information across US communities, national chapters should include all US islands and territories in their figures and assessments whenever possible.

³ See <https://nysclimateimpacts.org>.

Access to climate observations, projections, and assessments is not equitable across US territories, particularly for US-affiliated islands in the Pacific and Caribbean, which is noted in the respective regional chapters. NCA5 provides an opportunity to increase equity in this area, and every effort should be made to do so. Many figures in national chapters do not include the US Caribbean, and while many figures do include Hawai‘i, virtually no figures include the other US-Affiliated Pacific Islands despite the availability of information to do so. Whenever satellite data or global model output is used to generate national figures (e.g., Figures 2.4, 2.5, 3.7, 4.3), NCA5 should include a complete map of all island territories. If no data are available for these regions, the figure caption should state this to be the case (e.g., Figure 2.10). The Committee recognizes that including all island territories is not always optimal when attempting to produce legible figures for the contiguous United States due to the geographic extent of the US-Affiliated Pacific Islands. In such cases, the Committee recommends that separate figures be created for regions that are not included, that these figures be aggregated in an appendix, and that figure captions in national chapters point to this appendix for maps of regions not shown. Finally, the national chapters should strive to be more inclusive of island territories in textual statements and assessments of climate-related impacts and risks.

AREAS TO ADD EMPHASIS

Recommendation 14: Relatively more emphasis should be placed on the topics of: mitigation, adaptation successes and shortcomings, projected impacts of climate change, attribution of extreme events, and rural analysis.

In reviewing the draft NCA5 report as a whole, the Committee identified a number of topical areas where relatively more emphasis could be placed. In this section, the Committee outlines topics that should receive more complete attention across the report and identifies specific examples or inconsistencies across the report.

Mitigation

The treatment of GHG mitigation is uneven across the draft NCA5 report and should receive more attention in many of the chapters, consistent with its treatment in Chapter 1 (Overview). On the one hand, Chapter 32 of the draft NCA5 report is devoted to mitigation. In contrast, national chapters do not consistently emphasize mitigation or draw connections to Chapter 32 (Mitigation). Most notably, chapters on sectors that have significant GHG emissions or removals treat mitigation inconsistently. For example, Chapters 12 (Built Environment, Urban Systems, and Cities) and 13 (Transportation) have key messages on mitigation (i.e., Key Message 12.3, Key Message 13.1). On the other hand, Chapters 7 (Forests) and 11 (Agriculture, Food Systems, and Rural Communities) address GHG emissions with a focus on removals in text boxes, and Chapter 5 (Energy Supply, Delivery, and Demand) addresses GHG mitigation together with adaptation but does not include emissions or mitigation in any of the key messages. Some chapters discuss adaptation and mitigation as a grouped topic (e.g., Chapter 16 [Tribes and Indigenous Peoples], Chapter 15 [Human Health]), but then only examples of adaptation are provided with no specific discussion on mitigation. The inconsistent attention to mitigation

extends to the regional chapters. While Chapter 21 (Northeast) summarizes state GHG mitigation plans in a box and Chapters 26 (Southern Great Plains) and 28 (Southwest) summarize mitigation actions in the regions in figures, the other regional chapters say very little or nothing, or may discuss emissions reductions but do not refer to the actions as “mitigation” (e.g., Chapter 25 [Northern Great Plains]). Given the importance of mitigation in the consideration of climate change impacts in the future and the substantial knowledge base on mitigation, a greater emphasis on mitigation in the United States is appropriate.

Adaptation Successes and Shortcomings

Significant adaptation efforts are happening across the United States at all different scales. Summarizing the breadth of adaptation efforts is difficult because the United States lacks transparent and credible mechanisms to aggregate and assess the combined effectiveness of these measures regionally and nationally. The draft NCA5 report provides a competing dual analysis of adaptation. Many chapters describe specific adaptations, such as Chapter 21 (Northeast), that lists state and tribal adaptation plans. While recent work on adaptation is impressive, the recitation of adaptations does not assess whether and to what extent these measures will be successful in reducing risks from climate change. In contrast, Chapter 31 (Adaptation) finds that without a more dedicated effort toward transformation, the current trajectory of adaptations will be inadequate to fully mitigate the increasing risks from climate change and examines the need for transformative adaptation. Both views provide important insights—adaptations are being made but appear inadequate to fully adapt to how the climate may change. Chapter 31 (Adaptation) should better integrate these two points, and the synthesis of these two approaches to assessing adaptation should be carefully reflected in Chapter 1 (Overview). It would be appropriate for national and regional chapters to coordinate their discussions of adaptation to be consistent with the framework outlined in Chapter 31 (Adaptation). It may also be appropriate for NCA5 authors to acknowledge that adaptation actions related to infrastructure, human health, local economies, ecosystems, and emergency management are often about changing an element of a larger project that is already scheduled to occur, making projects challenging to assess as standalone adaptation actions.

Projected Impacts of Climate Change

The impacts of climate change are increasing, resulting in greater impacts on health, the built environment, and natural systems. However, the focus of many key messages across the draft NCA5 report is on recent observed changes and impacts. As noted above, a key requirement of the GCRA is to report on projected climate change impacts, specifically 25 to 100 years into the future, and relatively more emphasis on projected impacts is needed. For example, some sector chapters, such as Chapter 12 (Built Environment) and Chapter 13 (Transportation) devote little attention to projected climate change impacts. Many regional chapters focus only on recent impacts and would benefit from discussing projections and key uncertainties (e.g., Chapters 27 [Northwest], 29 [Alaska]). Furthermore, there is a tendency in some key messages (e.g., Key Message 4.1) to conflate or switch between current and projected changes in a confusing way. Care should be given not to intermix statements about observed and projected

changes in key messages. Recommendation 8 above details the suggested use of scenarios when projections are included.

Attribution of Extreme Events

The Committee commends the discussion in the draft NCA5 report on recent observed extreme events that identify how vulnerable society and nature are to climate change. Attribution of such events is an emerging field of research (e.g., NASEM, 2016). In many cases in the draft NCA5 report, extreme climate or weather are discussed (e.g., Chapters 4 [Water], 11 [Agriculture, Food Systems, and Rural Communities], 12 [Built Environment, Urban Systems, and Cities], 28 [Southwest]) but there is little or no discussion disentangling natural variability from climate change as causes of extreme events, as discussed above. For example, Chapter 28 (Southwest) discusses the current mega-drought affecting the entire region and cites Williams et al. (2022) but does not mention the causes of the drought or that the reference concludes that while climate change is making the drought more severe and long-lasting, natural variability has a relatively greater contribution to the severity of the drought than does climate change. As another example, the text in Chapter 1 (Overview) and Figure 1.4 are misleading because they imply the increase in the number of billion-dollar disasters is solely due to more intense weather and climate events. However, societal exposure to such events caused by population and property increases in hazardous areas also plays a significant role (see Figure 1.4 and explanatory text; Figure 2.6 and accompanying text; and Appendix 4, Figure A4.5). Chapters should be carefully written to emphasize that many extreme events have a higher likelihood of occurring due to climate change, rather than directly attributing extreme events to climate change, unless there is evidence to support the statement. Without precise attribution of extreme events, readers could be left with the impression that these events are entirely the result of climate change. There is an opportunity to expand the discussion of attribution of extreme events in the main text of Chapter 3 (Earth System Processes) to describe the concept in a more accessible way, the use of attribution studies and their limitations, and progress in the knowledge base since NCA4.

Rural Analysis

Rural communities are covered in Chapter 11 (Agriculture, Food Systems, and Rural Communities) and urban communities are covered in Chapter 12 (Built Environment, Urban Systems, and Cities). Impacts on urban communities are also addressed in other chapters of the draft NCA5 report, but the unique challenges and opportunities for rural communities are not adequately addressed. A more balanced discussion of rural communities would support the framework recommended for equity and justice, provided above. For example, Chapter 13 (Transportation) focuses on transportation networks in cities and omits discussions of rural mobility. Chapter 14 (Air Quality) covers environmental justice and air pollution risks in urban areas, with little attention to such risks in rural areas. Chapter 15 (Human Health) makes passing mention of rural farmers but does not discuss issues specific to rural communities (e.g., access to health care). Even though Chapter 12 (Built Environment, Urban Systems, and Cities) is focused on the built environment in urban areas, the built environment in rural areas is not covered in the

draft NCA5 report. The regional chapters generally do a better job of commenting on rural areas, though there are opportunities, for example, in Chapter 28 (Southwest), to place more emphasis on rural areas.

3

Chapter Comments

This chapter provides comprehensive reviews of each draft Fifth National Climate Assessment (NCA5) report chapter followed by the five Focus On... Features. Chapter comments respond to the questions outlined in the Committee's Statement of Task (see Chapter 1 of this report). For each chapter, the Committee provides comments following a consistent structure: summary of the Committee's comments; comments on the chapter introduction; comments on key messages, supporting information, and traceable accounts; comments on graphics and boxes; comments on equity and justice; comments on data and analyses; comments on literature cited; and other recommended changes. Reviews of the draft NCA5 report chapters with different structures (i.e., Front Matter, Chapter 1 [Overview], Appendixes) deviate from this general structure. Appendix A of this report provides detailed line-by-line comments for each draft NCA5 report chapter, as appropriate, and the References chapter includes a complete list of references for all suggested additions to the literature cited in the draft NCA5 report.

CHAPTER 0: FRONT MATTER

The Front Matter is well written and provides an accessible guide to the organization of the draft NCA5 report and guidance to readers on how to read it. The draft NCA5 report has a single Overview chapter (Chapter 1) focused on the report's findings, thus, the Front Matter could better introduce concepts and metrics that are relied upon throughout NCA5. The Committee suggests expanding the current discussion to elaborate on elements critical to understanding NCA5. For example, as discussed in detail in Chapter 2 of this report, the discussion of confidence and likelihood could be expanded on for general audiences.

In addition, the Front Matter states that "NCA5 authors were advised to assess the full range of scenarios available" (page 0-11, line 16), but some projections in the subsequent chapters report on just one scenario. There is some inconsistency throughout the report when projections are presented, and additional information could be provided in the Front Matter for clarification. For example: Were authors given any direction on which scenario to use when presenting future climate change impacts? Did authors consider consistently presenting more than one scenario (i.e., Low and High)? The Committee suggests including an explanation on the use of scenarios throughout the report. Consistent with the recommendation in Chapter 2 of this report to place relatively more emphasis on mitigation, it may also be useful as part of the introduction of scenarios in the Front Matter to include indicators of current policy scenarios to help audiences make the connection between often abstract emission scenarios and current policy.

The Front Matter of the draft NCA5 report does not currently comment on its intended audiences. Overall, the key messages and main text are appropriate for the intended audiences; however, there are instances in which the text is too technical or uses jargon, as detailed in the individual chapter reviews. The Front Matter may benefit from an explanation of the NCA5 authors' target audiences, as well as the intended audiences and use of the more technical traceable accounts sections.

The Committee suggests the Front Matter include a definition of the term “risk,” which is widely used throughout the draft NCA5 report but is never clearly defined. For example, the Front Matter could adopt a definition that is closely aligned with the Intergovernmental Panel on Climate Change (IPCC) definition of risk as the confluence of hazard, exposure, and vulnerability (IPCC, 2021b), if that is consistent with its use throughout NCA5.

Chapter 2 of this report notes that chapters throughout the draft NCA5 report use different structures to meet their topical needs. While these differences are appropriate, the Committee suggests the Front Matter note where different structures are used, and if possible, explain the process that led to their development.

Additionally, the map of NCA5 regions in Figure 1 could be improved. Authors should consider using boxes or lines to separate the different geographic domains being represented. In addition, because it is the first map readers will see when they start the report from the beginning, it would be useful to design the map in such a way to show oceans and connected countries.

Table 3 would be more useful if it presented projected carbon dioxide (CO₂) concentrations and levels of increases in global mean temperature at a particular point in time. To be consistent with the Global Change Research Act (GCRA), the Committee suggests presenting projections 25 to 100 years into the future.

Box 1 provides useful information on projected levels of warming and how to interpret them.

CHAPTER 1: OVERVIEW

Summary

Chapter 1 (Overview) is well organized and presents a set of findings that overall reflect the key themes from the underlying chapters in the draft NCA5 report. For the most part, this chapter is clear and written at a technical level appropriate for broad audiences. The Committee has the following main suggestions for improvement, and specific line-by-line comments are included in Appendix A:

1. Chapter 1 (Overview) should better cover the breadth of key messages and related information in the draft NCA5 report to accurately present a comprehensive synthesis of the report related to observed and projected climate change impacts, mitigation, and adaptation. While quite broad in its summary of the draft NCA5 report, this chapter does not discuss some important topics that are covered in the report such as the role of greenhouse gas (GHG) sequestration; low-carbon power sources for mitigation; the limited and, in many cases, transient climate change benefits in some sectors and regions; and geographic coverage of the entire United States, including territories.
2. In some instances, Chapter 1 (Overview) makes statements that could be perceived as policy prescriptive, including preferences for particular policy outcomes such as levels of mitigation or expressing a desire for certain forms of transformative mitigation or adaptation. It is appropriate for NCA5 to provide information that is policy relevant but not to express policy preferences or prescriptions.

3. In a few cases, based on what is presented in the draft NCA5 report chapters, the Committee is concerned that the confidence findings are misrepresented in Chapter 1 (Overview). This discrepancy is most noticeable where projections are stated using “will,” but the underlying state of knowledge as expressed in traceable accounts does not justify such a high level of confidence.
4. In many cases, Chapter 1 (Overview) does not put impacts or extreme events in appropriate context, thus potentially creating the misleading impression that impacts are solely caused by climate change. This includes sectors and impacts that are affected by other global changes or societal changes and weather and climate events that may be affected by natural variability as well as climate change.
5. Chapter 1 (Overview) does not address whether adaptation has the potential to offset projected adverse impacts of climate change or whether there are limits to adaptation, particularly at higher levels of warming.

Chapter 1 (Overview) is a comprehensive assessment of the state of knowledge on climate change and addresses all the topics specified in the GCRA. However, Chapter 1 (Overview) does not specifically identify projected impacts of climate change 25 to 100 years in the future as required by the GCRA, reflecting the lack of projections particularly 100 years in the future throughout the draft NCA5 report, identified in Chapter 2 of this report. In some cases, projected impacts are provided for mid-century or for a given level of warming, but many are expressed without a time frame or specific increase in average global temperature.

Review Comments Related to the Statement of Task

Comments on Chapter Organization

The Committee commends the NCA5 authors for developing a single chapter to summarize and synthesize the report, rather than including both a Summary and an Overview as was done in the Fourth National Climate Assessment (NCA4). This change helps make the introductory information clearer and more concise in the draft NCA5 report. Chapter 1 (Overview) generally synthesizes key messages from the draft NCA5 report into broader cross-cutting messages well, and accurately summarizes new science on climate change and key findings on observed and projected impacts of climate change since NCA4. Overall, Chapter 1 (Overview) is well structured and appropriately written for broad audiences. Specifically, the Committee commends the emphasis on mitigation and adaptation efforts by noting in Section 1 both that progress is occurring to advance these efforts and that more is needed to meet stated emissions goals. However, while Chapter 1 (Overview) does discuss mitigation, often mitigation efforts are discussed in conjunction with adaptation measures. The Committee suggests that Chapter 1 (Overview) provide definitions and context to facilitate a greater understanding by broad audiences. For example, the text in Chapter 1 (Overview) should provide clear definitions for adaptation and mitigation that include answers to the following: what is mitigation; how does mitigation differ from adaptation; what time frames matter for mitigation efforts, and why. This context, which is presently omitted, will take up only a small amount of text, vastly increase accessibility to all audiences, and better set the stage for the rest of the chapters in NCA5. Additionally, since the draft NCA5 report utilizes an iterative risk management approach,

chapter authors may point out that mitigation is the primary tool to reduce likelihood broadly, while adaptation reduces consequence locally.

Comments on Consistency with Report Text

The Committee recognizes that it is challenging to decide which messages and supporting information are important to include in Chapter 1 (Overview) of such a comprehensive report. However, in some cases, the chapter is not consistent with the body of the report. For example, in the Chapter 1 (Overview) discussion on the specific needs to meet stated emissions goals in the coming years, there is a focus on renewable energy without any discussion of other options for reducing net GHG emissions or radiative forcing. However, several other chapters discuss the importance of options such as carbon capture and carbon sequestration (e.g., Chapter 8 [Ecosystems, Ecosystem Services, and Biodiversity], Chapter 11 [Agriculture, Food Systems, and Rural Communities], and Chapter 32 [Mitigation]), and energy conservation, nuclear power, or new technologies such as hydrogen fuels (e.g., Chapter 32 [Mitigation]).

Additionally, in summarizing sector and regional impacts, Chapter 1 (Overview) only mentions adverse impacts of climate change and does not mention the mix of impacts reported for some sectors and in some regions. This is most notable in Table 1.2 (see Appendix A for specific comments). Specifically, chapters such as Chapter 25 (Northern Great Plains) and 19 (Economics) describe a mix of impacts—often where there are some beneficial effects associated with trade-offs. For example, energy use and recreation are estimated to have a mix of impacts. Chapter 19 (Economics) shows in Figure 19.1 that expenses for electricity are projected to increase while expenses for fossil fuel use are projected to decrease. Additionally, the draft NCA5 report points out in many cases that cold weather recreation is expected to decrease due to warming temperatures and changing precipitation patterns, but it does not fully address how warm weather recreation could change. The Committee suggests that Chapter 1 (Overview) more accurately and transparently represent a mix of impacts associated with climate change as reported in some national and regional chapters, while highlighting that the knowledge base consistently finds that the net effect of climate change is projected to be negative, and increasingly negative with additional levels of warming.

Care is needed to ensure that Chapter 1 (Overview) accurately reflects confidence and likelihood statements in sector and regional key messages and their supporting traceable accounts. For example, Chapter 1 (Overview) appears to overstate levels of confidence and likelihood in its statements on agriculture and the relationship between incremental increases in temperature and damages compared to the levels of confidence and likelihood that are expressed in Chapters 11 (Agriculture, Food Systems, and Rural Communities) and 19 (Economics). To state an outcome “will” happen can be interpreted as having the same as finding the outcome is *virtually certain* with *high confidence*. Chapter 1 (Overview) states that climate change “will” make food less accessible and more expensive (Section 3.2, page 1-18, lines 14-15). Key Message 11.2 states that, based on projections, the outcome is *likely* with *medium confidence* because there are relatively few studies, in addition to other factors such as adaptation and baseline changes that can have an important effect on vulnerability. Thus, these qualifications provided in Chapter 11 (Agriculture, Food Systems, and Rural Communities) do not support attaching “will” to findings on climate change and food production.

Chapter 1 (Overview) also states, “Each additional increment of warming will cause more damage and greater economic losses than previous warming, while the risk of catastrophic

or unforeseen consequences also increases” (Section 1.1, page 1-4, lines 14-15). The Committee agrees that the evidence presented in the draft NCA5 report and the broader knowledge base supports the expectation that with increasing changes in warming, there will be increasing net damages. However, the Committee questions whether the use of the word “will” is appropriate for this finding. There are important uncertainties regarding climate change, impacts, adaptation, and baseline changes that justify less than complete certainty in this finding. The traceable account for Key Message 19.1, for example, points out many important uncertainties regarding the relationship between increased warming and damages. An indication of some uncertainty in this finding would be more consistent with the state of knowledge expressed in Chapter 19 (Economics) and could be addressed by substituting language from Chapter 19, “with every additional degree of warming, the United States overall is expected to see increasingly adverse consequences.” The second clause of the sentence is appropriate and should remain as written.

Comments on Top-Line Messages

Most of the top-line messages in Chapter 1 (Overview) are clearly stated and supported by subsequent chapters. However, Section 5 (“How We Move Forward”) has some findings that may be perceived as policy prescriptive. For example, statements that transformative adaptation reduces inequalities is not a statement of fact (Section 5.3, page 1-39, lines 1-24). While transformative adaptation can reduce inequalities, some transformative adaptations may not reduce or could even exacerbate inequalities if not carefully pursued through an equity lens, as noted in Chapter 31 (Adaptation). The Committee suggests carefully rewording statements like these that state values to be policy informative without being policy prescriptive.

Additionally, some of the subsection headers need clarification. For example, the headers for subsections 1.3 (“Adaptation is moving forward across the country”) and 1.4 (“Communities are taking action to strengthen resilience”) are similar and authors should clarify the distinction between the two and consider an alternative header for subsection 1.4 such as “Communities are acting on climate change.” The header for subsection 4.2 (“Rising emissions are driving rapid global warming”) is also ambiguous given that the rate that emissions rise depends on the timescale considered and should be rephrased. Furthermore, many headers in Section 3 (“The Risks We Are Facing”) are overly broad. For example, in Section 3.8 (“Regional economies and livelihoods”), while many livelihoods, cultures, heritages, and traditions are being adversely affected by climate change, the section title can be read to imply that all of the components of these categories are adversely affected. Some rephrasing could address this concern—for example, use “many livelihoods” or state “cultures, heritages, and traditions” are being affected.

Comments on Documentation from Other Chapters

In general, the individual chapters are appropriately addressed and referenced in Chapter 1 (Overview); however, there are several exceptions. For example, page 1-20, lines 31-33, states that sea-level rise (SLR), fire, and flooding are expected to displace millions of Americans, but it is not clear where the magnitude of displacement (i.e., millions of people) is stated in the chapters or in the underlying literature. Furthermore, Chapter 19 (Economics) discusses migration but states that specific impacts, such as levels of migration, are uncertain (page 19-12, lines 7-8). Appendix A identifies additional discrepancies between the draft NCA5 report

chapters and Chapter 1 (Overview) and makes suggestions for cross-referencing specific chapters.

Comments on Graphics and Boxes

While some figures in Chapter 1 (Overview) were not available for the Committee to review, the figures that are displayed were generally clear and informative.

The title of Figure 1.2 should indicate the time period of the data portrayed. The caption should address the geographic areas where warming has not appeared to have occurred or, if appropriate, point out where in the report this topic is addressed.

The text and Figure 1.4 are misleading because they imply the increase in number of billion-dollar disasters is solely due to more intense weather and climate events. Non-climate stressors also contribute to the increase in such disasters, such as population growth, particularly in areas most exposed to climate hazards, and property values, which have increased faster than the general rate of inflation. Figure 2.6 in Chapter 2 (Climate Trends) displays billion-dollar disasters in 2021 but does not address how the number of such disasters has changed over time. Thus, Figure 1.4 appears to be presenting information not found in the body of the draft NCA5 report. Additional comments are provided in Appendix A.

The titles and labeling of Figure 1.18 are confusing. The figure appears to display the relative cost effectiveness of emissions reduction options, not how much carbon will not be emitted. While the figure is still under development, as depicted, it is unclear based on the multiple titles and labels on the figure whether the figure is showing emissions reduction potential by abatement measure, savings per abatement measure, cost per million metric tons (MMT) of CO₂-equivalent offset by each abatement measure, incremental cost per MMT of CO₂-equivalent offset by each abatement measure, or some combination. The figure title and label of the x-axis should be rewritten to make it clear that the figure is displaying dollar per ton of net emission reduction. Additionally, the Committee suggests that the figure be modified to use more distinct color gradients (blues and yellows are tough to discern). Finally, in the caption, the term “marginal costs” should be explained, as well as the key take aways from the figure.

Table 1.1 provides good examples of adaptation, but the examples are limited. While it is challenging to portray comprehensive examples of promising adaptations, one option would be to include broader efforts such as federal and state adaptation measures along with local measures.

The structure of Table 1.2 is useful. However, the title of Table 1.2, “All Regions Are Experiencing a Mix of Adverse Impacts” is not clear on what a “mix of adverse impacts” means. In addition, the table does not reflect the mix impacts presented in some chapters of the draft NCA5 report. For example, entries for the Northeast, Midwest, and Northern Great Plains focus on adverse impacts; not all livelihoods will be harmed, and some could benefit.

Comments on Equity and Justice

Overall, equity and justice issues are appropriately addressed and well-integrated in Chapter 1 (Overview). The chapter authors provide important historical drivers of inequity and include present-day implications. Systemic interconnections are well addressed and provide strong framing across the chapter. The chapter authors do not focus on only race/ethnicity and economic status when addressing inequity and vulnerability, but also highlight other historically

overburdened communities as well as geographic vulnerabilities (i.e., rural areas) and occupational vulnerabilities (i.e., small fisheries).

However, the Committee suggests several minor improvements. Consistent with the recommendation in Chapter 2 of this report, Chapter 1 (Overview) should use more consistent terminology; for example, “under-resourced,” “overburdened,” and “frontline” seem to be used interchangeably in the chapter. Chapter 1 (Overview) should adopt consistent terminology that will be used throughout NCA5. Chapter authors may consider including the concept of intersectionality and its relationship to climate vulnerability. Some attention to data justice, or the availability and accessibility of relevant data to communities, may be warranted in some contexts; for example, it is a broad and unbacked assumption that “communities are now equipped with a stronger understanding of the risks they face” (page 1-4, lines 4-5) as accessibility to relevant climate data is highly variable. Finally, the Committee also suggests including “intergenerational justice” in the list of relevant forms of justice in subsection 5.5 (“Transformative change is an opportunity for a more just Nation”). Additional specific suggestions are identified in Appendix A.

Comments on Data and Analyses

This chapter presents some data from underlying chapters and in general, these are presented well. The Committee notes concerns above about figure titles and captions that could be clearer and should present appropriate caveats about the data being presented. The chapter should adopt a standard dataset framework (e.g., GHG emissions), consistent with the recommendation in Chapter 2 of this report, so that references to data are always consistent and correct.

Other Recommended Changes

In many cases, Chapter 1 (Overview) does not put impacts in the appropriate context, which could create the misleading impression that impacts, including some changes in extreme events, are entirely caused by climate change. For example, regarding impacts on ecosystems, Chapter 1 (Overview) should state that ecosystems are also being degraded by other global changes such as land-use, habitat fragmentation, pollution, and overfishing. The chapter should point out that some extreme events are partly the result of natural variability, as well as climate change.

In general, the chapter does not address whether adaptation has the potential to offset projected adverse impacts of climate change, nor does it examine limits to adaptation. While Chapter 31 (Adaptation) discusses limits to incremental adaptation and the need for transformative adaptation, evaluating both the possibilities and limitations of adaptation is essential to every sector for future planning, and should be addressed in the chapter. The Committee notes that this is a challenging topic to assess; however, some discussion is warranted either highlighting the knowledge gap or explaining why these topics were not addressed.

The implications of international impacts of a changing climate on the United States, including possible effects on national security and the opening of the Arctic to shipping and resource extraction, are not addressed in the chapter, except for migration.

Finally, the Committee questions the citation of global economic damages that is drawn from Chapter 17 (Climate Effects on US International Interests). Since the draft NCA5 report

focuses on impacts on the United States, the Committee suggests Chapter 1 (Overview) cite findings from Chapter 19 (Economics) on estimated impacts of climate change on US gross domestic product (GDP) (e.g., US GDP is projected to fall by 0.13% per degree Fahrenheit increase; page 19-12, lines 25-27).

CHAPTER 2: CLIMATE TRENDS

Summary

This chapter summarizes the observed climate trends in the United States and their causes and impacts, providing a foundation for the rest of NCA5. The chapter is written in a consistent, transparent, and credible way and does a great job of using accessible language and not assuming knowledge of scientific terms and jargon. While the chapter covers a wide range of topics, including temperature, rainfall, and sea-level, among others, the discussion and references regarding the role of natural climate variability and its regional differences are missing. The key messages are well stated and supported by the details provided. The chapter meets the requirements of Section 106 of the GCRA. This chapter and Chapter 3 (Earth System Processes) should be better coordinated, described below and in the Committee's review of Chapter 3 (Earth System Processes).

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction is generally well written. It not only provides a useful background for the subsequent three key messages, but also discusses connections to other chapters. The introduction could be improved by adding more discussion of the connection to Chapter 3 (Earth System Processes)—specifically, to explain the overlap between the two chapters and distinguish each chapter's focus. Highlighting these connections is especially important as these two chapters provide foundational information for the following national and regional chapters; thus, later chapters should be able to clearly reference pertinent physical science in each of these chapters. Because this chapter relies on IPCC reports, it would be useful to make clearer when references are being made to that source, and more attention could be given to what is new in this chapter compared to NCA4. Additionally, "climate trends" is an incredibly broad topic that cannot fully be covered within this chapter; therefore, it is important for the introduction to include a statement about the information that is not included in the chapter.

Comments on Key Messages, Supporting Information, and Traceable Accounts

The key messages are generally well written, at the appropriate technical level. They reflect current understanding about observed and projected impacts to the United States, the challenges, opportunities, and success stories for addressing risk; and identification of emerging issues related to climate change. Assessments of confidence and likelihood are included, though chapter authors could consider always putting confidence/likelihood language in parentheses for

clarity. In the key message titles and subsection headers, authors should avoid using personal pronouns because they lack clarity and should also exercise caution when making declarative statements in headers that are not supported by the corresponding text.

One major issue missing from this chapter is a comprehensive discussion of the issue of ocean acidification, which is likely to have profound impacts on natural ecosystems, as well as ocean resources such as fisheries. There are currently a few mentions of this topic, but the discussion should be expanded.

Comments on Specific Key Message Language

Key Message 2.1. Climate Is Changing, and Scientists Understand Why

It is *virtually certain* that human activities have increased atmospheric levels of carbon dioxide and other greenhouse gases (*very high confidence*). Global average temperature has risen in response, with even more warming experienced in the continental United States and Alaska (*virtually certain, very high confidence*). Long-term changes have been observed in many other aspects of the climate system (*very high confidence*). The Earth system is complex and interconnected, which means changes in faraway regions also affect the United States (*high confidence*).

Key Message 2.1 is well written and sets the foundation for the other two key messages by emphasizing the fact that the climate has already been changing. This key message also provides a single location where almost all of the climate changes discussed and expanded upon elsewhere are introduced for use by the other chapters.

Key Message 2.2. The Risk of Extreme Events Is Increasing

Observations show an increase in the severity, extent, and/or frequency of multiple types of extreme events (*very high confidence*). Heatwaves have become more common since the 1980s (*very high confidence*). Drought risk has been increasing in the Southwest over the past century (*very high confidence*) and decreasing elsewhere (*medium confidence*). Rainfall has become more extreme in recent decades, especially east of the Rockies (*very high confidence*). Hurricanes are intensifying more rapidly (*high confidence*) and causing heavier rainfall and higher storm surges (*high confidence*). More frequent and larger wildfires have been burning in the West in the past few decades due to a combination of climate factors and policy (*high confidence*).

Suggested title: “Extreme Events Are Becoming More Frequent and Severe.”

Key Message 2.2 is another generally well written key message. However, while the title of this key message includes the word “risk,” the key message is exclusively about hazard. The Committee suggests rewriting the key message title to more accurately reflect the discussion on hazards.

Key Message 2.3. The Future Is in Our Hands

The more the planet warms, the greater the impacts—and the greater the risk of unforeseen consequences (*very high confidence*). Scientists understand much about the Earth system, but there are still uncertainties about how the planet will react to rapid warming. Risks increase with warming, and warming increases with emissions (*very high*

confidence). Reducing emissions would limit future warming (*very high confidence*) and the associated increases in risks (*medium confidence*). While worst-case scenarios cannot be ruled out, the future is largely in our hands.

This key message title is not scientific and seems to ignore equity and justice concerns on the very question of who has the power in the United States to shape climate and energy policy. The title does not describe the information included in the supporting text well—the audiences would expect the text supporting this key message to be about policy actions, but a more appropriate title would have to do with climate impacts. Additionally, this key message could be more direct if it began with the third sentence and the first two sentences were removed. Furthermore, the Committee suggests that authors avoid using first person language in the title and key message.

Comments on Text Supporting the Key Messages

The text supporting the key messages is generally well written and contains sufficient details that provide further context. Detailed comments on the text are provided in Appendix A. Some of the statements, including section headers, however, should be clarified. For example, the section header, “The Nation Has No Choice But to Adapt to a Changing Climate” is unclear because “the Nation” can refer to both the people of the United States and the government, and the supporting text in the section only makes broad statements about “the Nation.” The Committee suggests rephrasing the section header to be more precise, for example, “Adaptation can address climate change impacts.”

When discussing regional differences in climate trends across the United States, the impact of natural climate variability is mostly ignored with a few exceptions. The role of natural climate variability and its interaction with human-induced climate trends in temperature, precipitation, and sea-level is documented widely in the scientific literature and is essential for proper interpretation of observations. It is important to point out that locations where natural climate variability is currently suppressing the impact of climate change can expect to experience rapid increase in the suppressed variable if/when the natural variability changes phase (e.g., sea-level rise [SLR] along the west coast of North America). It is also important to point out that the influence of natural climate variability becomes particularly strong when the climate trend is computed based on short periods of time or small geographic areas.

The title of the subsection “Sea Level Rise Will Continue to Accelerate” implies too much certainty. For example, global SLR under Shared Socioeconomic Pathway (SSP) 1-1.9 does not continue to accelerate. Even though this is the Very Low Emissions scenario, and even though a case could be made that the probability of a very low emissions future is low, the title of this key message is “The future is in our hands.” If emissions were drastically curbed emissions starting now, SLR may not continue to accelerate. The Committee suggests changing the title to “Sea Level Rise Is Expected to Continue Accelerating.” Within this subsection, it should be noted under what conditions (i.e., emissions scenarios excluding Very Low) SLR is expected to accelerate. However, even within a higher emissions scenario, there may be individual ensemble members for which SLR does not accelerate, and herein lies an important distinction between projections and scenarios. Likelihood statements (including the word “expected”) can be made using projections based on emissions scenarios. Likelihood statements should not be made based on SLR scenarios. In general, a distinction should be made between

projections and scenarios here and throughout NCA5. Also in this section, the word “likely” is used often. Is this word used in the context of NCA5 confidence/likelihood language? If not, a different word should be used. If so, the word should be italicized, and the justification for these likelihood statements should be based on projections (not scenarios) and added to the traceable accounts.

Comments on Traceable Accounts

This chapter could better identify and provide sufficient context for embedded content and explain how the chapter content reflects current scientific understanding by following the recommended framework for traceable accounts sections in Chapter 2 of this report. In addition to the introduction, relevant connections to Chapter 3 may also be appropriate. The “Major Uncertainties and Research Gaps” section listed under Key Message 2.1 seems arbitrary. Chapter authors should remove subtitles and add discussion of other sources of uncertainties and gaps. The Committee suggests referencing the recommendation in Chapter 2 of this report for more guidance on enhancing traceable accounts.

Comments on Graphics and Boxes

Graphics in this chapter are generally effective and appropriate, though improvements would increase accessibility for the intended audiences. Several figures (e.g., Figures 2.2, 2.7) are highly technical and could be better presented for general audiences. Figure captions should be expanded to discuss what the figures mean rather than just what exactly they show. Many figures in this chapter could be made larger or broken out into separate figures to enhance readability.

Figure 2.4 is informative, and the first sentence of the caption is a good example of explaining what the figure means, although even “obvious” points like “With differences from region to region and season to season” might be useful additions for general audiences. In general, figure captions should be as much about what the reader should learn from the figure as about its technical sources (e.g., the caption for Figure 2.4 is one line of “what it shows” and six lines about where it comes from). In addition, showing how temperature and precipitation changes (in degrees and by percent from the average) compared to the natural variabilities (e.g., masking by T test) would be helpful.

The US-Affiliated Pacific Islands (USAPI) and in most cases the US Virgin Islands (USVI) are missing from figures (Figures 2.2, 2.4, 2.5, 2.7, 2.8, 2.9, 2.12) and text. If NCA5 is to be equitable, it should support and provide relevant climate information equally across all United States lands and territories. If the USAPI and USVI do not fit nicely into the current figure formats (it is understandable if they do not), then additional figures should be made and provided in an appendix of figures specifically for USAPI and USVI locations, which can be referenced in the text to point interested readers and decision makers to the relevant information for these locations. This should be possible for any maps based on satellite data or global models (e.g., Coupled Model Intercomparison Project Phase 6 [CMIP6]).

Comments on Equity and Justice

The introduction merely mentions that “Black Americans die from heat-related diseases at a rate twice that of the general population (EPA 2022b).” The Committee suggests highlighting how climate trends relate to equity and justice in the introduction and integrating associated dimensions (distribution of benefits and burdens, recognitional, procedural, intergenerational justice) in the chapter body as appropriate. Adding references to other chapters that discuss related equity and justice issues (e.g., disproportionate impacts from climate change) would help build consistency with the rest of the report.

Within the text, more effort should be made to assess the literature and make statements regarding observed and projected trends for the USAPI and US Caribbean. Not only would this support Chapters 23 (US Caribbean) and 30 (Hawai‘i and US-Affiliated Pacific Islands), but these regions are the most lacking in climate information. This report is an important opportunity to support climate information and decision making in these vulnerable territories.

Comments on Data and Analyses

Data and analysis adopted from other sources and presented in this chapter are appropriate. However, this chapter frequently switches between the Imperial and metric systems (e.g., Fahrenheit and Celsius, feet and meters) in both the text and figures. Consistent units should be used both across this chapter and in accordance with unit conventions adopted in other chapters of the report (i.e., Chapter 1 [Overview]).

Comments on Literature Cited

Overall, appropriate literature is cited. Some suggestions are listed below, and others can be found in Appendix A.

It is unclear how the reported amounts of averaged SLR along the continental United States (CONUS) coasts were obtained on page 2-24 lines 32-34. Assuming the source is Sweet et al. (2022), the values reported here are not provided explicitly in that reference. One could look at Table 2.4 in Sweet et al. (2022) and see that 2°C warming most closely corresponds to the Intermediate Low Scenario (50%), while the Low and Intermediate scenarios correspond to the tails of the probability distribution (98% and 2%, respectively). Chapter authors could then look at Table 2.3 in Sweet et al. (2022) and find a Low to Intermediate range for CONUS average sea-level of 0.6-1.2 m (2-4 ft) in 2100 and 0.8-2.2 m (2.5-7 ft) in 2150. Both ranges differ from the ranges given in the draft NCA5 report. For page 2-24, lines 36-37, the Committee assumes this statement is based on the Intermediate scenario, but the Intermediate scenario is just as likely from a probability standpoint as the Low scenario for 2°C warming. So, if it is very unlikely that CONUS SLR will exceed 4 feet in 2100 for 2°C warming, then it is also very unlikely it will be as low as 2 feet, which is reported as the lower bound of what appears to be a likely range two sentences prior. This section needs work to be internally consistent with the draft NCA5 report likelihood ranges, as well as Sweet et al. (2022) on which it is based.

Other Recommended Changes

On page 2-14, lines 12-13 state, “The number and cost of weather-related disasters has increased dramatically over the past four decades, in part due to the increasing frequency and severity of extreme events.” The statement is technically correct because increases in extreme events are “in part” the cause of increases in billion-dollar disasters. However, this section should also acknowledge the important trends in baseline socioeconomic conditions that have resulted in a significant increase in exposure to such events. Three contributing factors are (1) increased population—United States population rose from 226 million in 1980 to 331 million in 2020, a 46 percent increase¹; (2) the Consumer Price Index has been lower than increases in property values^{2,3}; and (3) there is evidence that there is more development in hazardous areas than in relatively safer areas and that development in hazardous areas is increasing more than in less hazardous areas in the United States (e.g., Iglesias et al., 2021). It is important that the draft NCA5 report put such data as change in billion-dollar disasters in appropriate context.

CHAPTER 3: EARTH SYSTEM PROCESSES**Summary**

Overall, Chapter 3 (Earth System Processes) adequately identifies and supports the key findings, and the authors should be commended for putting together a nice chapter on a short deadline. The chapter largely meets the requirements of Section 106 of the GCRA. Most of this chapter is a summary of the relevant IPCC chapters. This is an appropriate way to bridge between the IPCC, which represents 4 years of synthesis of the science from a 1,000-page document of global scope, and this document focused on the United States, especially in terms of impacts and mitigation. The language and confidence limits are in general well done. Below, the Committee focuses on issues that can be improved.

The first issue is the number of key messages: 12 for this chapter, while most other chapters have three to five. Consistency between chapters would improve the readability and usability of the document. The four “methods” key messages, and especially the descriptions of the scenarios and ensembles, could be better presented as subsections in the text supporting the key messages, appendixes, or perhaps boxes. Some of the scenario descriptions are in the Front Matter and in Appendix 3, which may be more appropriate instead of in Chapter 3 (Earth System Processes). Regardless, these scenario sections should be consistent and refer to each other. Some other key messages could be combined—for example, Key Messages 3.1 and 3.5 could be combined; Key Message 3.6 and 3.12 could be combined; and Key Messages 3.3 and 3.8 through 3.11 could be combined.

Second, there is substantial overlap in key message titles between this chapter and Chapter 2 (Climate Trends). The Committee notes that the separation of the physical science chapter into two is new in NCA5, so authors are working this out for the first time. Chapters 2 (Climate Trends) and 3 (Earth System Processes) should complement each other and be carefully balanced to have enough similar—but not entirely duplicated—information, designing the

¹ See <https://www.census.gov/data/tables/time-series/dec/popchange-data-text.html>.

² See <https://www.whitehouse.gov/cea/written-materials/2021/09/09/housing-prices-and-inflation>.

³ See <https://anytimeestimate.com/research/housing-prices-vs-inflation>.

separation of information to serve different purposes or audiences. It may help if the authors of these two chapters coordinate with each other to work out the best way to minimize the overlap while maintaining the completeness of discussion. It would help the reader if there was an explanation in the chapter introductions about what material is covered in each chapter, as well as some information in the Front Matter. In addition, Chapter 2 (Climate Trends) and Chapter 3 (Earth System Processes) should cross-reference each other frequently.

Third, one important role that this chapter could play is to provide technical background information (in service of the other chapters) at a level that general audiences could understand. Presenting a few introductory topics in clear language—for example, explaining how and why the odds of some extreme events are increasing, and how they are attributed to climate change—could make important topics accessible to general audiences, and would be particularly useful for many of the other chapters to reference. Attribution of extreme events is being reported in the newspapers all the time; explaining what readers should look for in such reporting and why attribution is important would provide a service to all NCA5 audiences.

Lastly, key message titles should be rewritten to be messages themselves. For example, “Key Message 3.2. Climate Sensitivity and Climate Feedback” could be replaced with “Climate sensitivity and climate feedbacks will determine future changes and impacts” or some other title that provides meaningful information.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

Overall, the introduction is nicely written but reads as more of a summary. Chapter 3 is one of the most technical chapters in the draft NCA5 report, so the authors should emphasize in an accessible way why the topics are important for the audiences. In the spirit of focusing on knowledge gains since NCA4, the introduction should explain that this chapter is a new addition since previous NCAs. An additional sentence or two on the following should also be incorporated: (1) what is described in this chapter versus Chapter 2 and (2) frame the chapter topics in the context of equity and justice.

Comments on Key Messages, Supporting Information, and Traceable Accounts

In general, the key messages are well written and present appropriate information. The number of key messages should be reduced to be consistent with other chapters, as suggested above. The key messages are short, so combining them should not be too difficult. There is also overlap with Chapter 2 on some topics, for example, climate drivers (e.g., GHGs, aerosols), extreme events (e.g., temperature and precipitation), the cryosphere, and SLR as well as the role of natural variability. Additionally, focusing on fewer topics (e.g., attribution of extreme events) and explaining them in a less technical way would be valuable. Finally, the key message titles themselves should contain information, not just be headers. There are confidence statements but no likelihood statements; these should consistently be provided across all chapters, consistent with recommendations in Chapter 2 of this report.

Comments on Key Messages and Supporting Information

Key Message 3.1. Drivers of Climate Change

Human activities—primarily emissions of greenhouse gases—have caused nearly all global warming observed over the industrial era (*very high confidence*). Changes in natural climate drivers had globally small and regionally variable long-term effects over that period (*high confidence*).

This is a well-written section, although there is some duplication with Chapter 2 that could be removed by adding cross-references.

Key Message 3.2. Climate Sensitivity and Climate Feedback

Recent improvements in the understanding of how climate feedbacks vary across timescales have narrowed the estimated *likely* range of warming expected from a doubling of atmospheric carbon dioxide by 50% to between 4.5°F and 7.2°F (*high confidence*).

This is a well written section; however, because it is a technical subject and consistent with suggestions above to combine key messages, this key message could be combined with others.

Key Message 3.3. Changes at Regional Scales

Changes in regional climate can differ substantially from changes in global-scale averages, and natural variability in the climate system limits the precision of regional-scale projections. Thus, it is important to account for regional differences as well as natural variability when providing climate change information. (*Very High Confidence*)

Key Message 3.3 is a solid key message, but all the references are to model studies. Referencing some observational papers or Chapter 2 (Climate Trends) would improve the flow, authority, and cohesiveness of this key message.

Key Message 3.4. New Scenarios and Climate Projections

A new generation of Earth system models has produced an updated set of projections under a number of newly developed policy-relevant scenarios. A number of Earth system models have been run at significantly higher resolution (about 20-50 km) than the previous standard (about 100-200 km) for focused experiments to explore particular aspects of climatic changes, like tropical cyclones, that cannot be simulated by coarser-resolution models.

Key Message 3.5. Large Ensemble Simulations

New experiments from multiple climate models that capture both natural variability uncertainty and model uncertainty have improved our ability to understand and quantify expected climatic changes and the relative contributions of human-caused climate change and natural climate variability at regional scales (*high confidence*).

Key Message 3.7. Observations for Improving Process Understanding and Modeling

Recently deployed observing systems have reduced uncertainty in climate projections and improved our understanding of the climate system. Important advances in understanding stem from the application of new techniques that synthesize information from models and both new and existing observation networks and new data on past climatic conditions. (*High Confidence*).

Key Messages 3.4, 3.5, and 3.7 are framed differently from the rest; they are simply introductions and are about methods rather than impacts, adaptations, or mitigation. It may be more appropriate to move them to Front Matter (under the “Scenarios” section) or to Appendix 3 or merge them into the other key messages (e.g., Key Message 3.4 into 3.1, Key Message 3.5 into 3.2 or 3.3, Key Message 3.6 into 3.12). For Key Message 3.5, multi-model ensembles should be emphasized, as within-model ensembles can contain structural biases.

Additionally, Key Message 3.7 may be more appropriate for Chapter 2 (Climate Trends) or may not be necessary for NCA5. The explanation for emergent constraints is technically difficult, not well motivated, and ultimately not clear enough for the broader audiences. Because this section would have to be expanded considerably to be readable for general audiences, and this information is not used often in the report, chapter authors could consider eliminating this section.

Key Message 3.6. Extreme Event Attribution

The science of evaluating the effects of human-caused climate change on extreme weather and climate events has advanced significantly. Human influence has changed the frequency and intensity of some types of extreme events, and it is now possible to quantify climate change effects on specific extreme events. (*High Confidence*).

In Key Message 3.6, page 3-18, lines 9-11 indicate that advancements in methods that allow for the almost immediate attribution of extreme events is important. “Almost in real time” could be added to the last sentence of Key Message 3.6. Such rapid attribution has become almost commonplace in the popular media since NCA4. As discussed above, because of its importance, this section could be expanded and written more clearly for broader audiences.

Key Message 3.8. Water Cycle Changes

Many processes relevant to the water cycle have already begun to change and are projected to continue changing as the planet warms, including atmospheric moisture (*high confidence*), atmospheric circulation, patterns of natural variability (*medium confidence*), and the modulating role of vegetation on evaporation (*low confidence*). These drive changes in the intensity of precipitation in extreme events; snowfall, snowpack, snow melt; and the seasonal cycles of average precipitation and evaporation.

Key Message 3.8 is an overall important topic that is well written but should be better coordinated with Chapter 4 (Water). There are some specific comments on this section in Appendix A, but a general point that should be made is that if natural variability increases in the future, it will be more difficult to separate natural from forced variability.

Key Message 3.9. Changes in the Carbon and Biogeochemical Cycles

Understanding of the biogeochemical responses to human-caused greenhouse gas emissions has increased due to expanded observations and improvements in models, but uncertainty in the future evolution of the global carbon cycle remains high (*high confidence*).

Key Message 3.9 is well done in general, but the carbon cycle could be emphasized in the title rather than biogeochemistry, which may be too technical a term. This key message is not discussed in Chapter 1 (Overview). Chapter authors should consider how to make this key message relevant to the Chapter 1 (Overview) (as an indication of its relevance to the report as a whole) or remove it as it is too technical.

Key Message 3.10. Changes in Ocean and Cryosphere and Sea Level Rise

New observations, models and reconstructions have improved understanding of the drivers of regional sea level rise (*high confidence*) and how processes combine to cause sea level change at the coast (*medium confidence*).

Key Message 3.10 is a good introduction to the global problem, but the regional variability in SLR should also be emphasized.

Key Message 3.11. Atmospheric Circulation Changes

Atmospheric circulations that affect US regional climate are influenced by the global warming-induced expansion of the tropics (*medium confidence*). However, identifying the relative contributions of natural variability and human-induced climate change to changes in regional atmospheric circulation remains challenging.

Key Message 3.11 could be incorporated into another key message, as it does not directly describe a hazard that impacts humans or ecosystems. It is also another highly technical message, largely beyond broader audiences as presented. If more space is needed, this message may be the most dispensable in this chapter.

Key Message 3.12. Changes in Extreme Events

Human activities are affecting climate system processes in ways that are expected to increase the frequency and intensity of many, but not all, climate extremes, including heat waves, wildfires, drought, heavy rainfall, and coastal flooding (*medium to high confidence*).

Key Message 3.12 is important and could contribute to a stronger report if it were more often referenced. This key message could be expanded to be clearer for broader audiences.

Comments on Traceable Accounts

Chapter 2 of this report provides recommendations for traceable accounts and approaches to ensure consistency across NCA5. There are a number of specific issues with the traceable accounts section in Chapter 3.

First, this chapter's traceable accounts include a list of the expertise of the scientists writing the report, which is a good idea but inconsistent with other chapters. As recommended in Chapter 2, the NCA5 authors should decide whether such a description will be consistently included in all chapters. Additionally, other chapters describe the data gathering process that authors used to develop the chapter—stakeholder engagements, how authors communicated amongst one another, and frequency of author meetings—a section that is omitted in this chapter.

Second, the knowledge base should emphasize data sources and papers rather than the opinion of scientists. There are many examples in the traceable accounts of this chapter where opinions of scientists are emphasized. As an illustration of the problem, the traceable account for Key Message 3.1 states “Scientists have known the potential for climate change due to CO₂ emitted from human activities since the early 20th century and identified other human drivers, including non-CO₂ GHGs, land-use change, and aerosols by the 1970s (Ramaswamy et al. 2019).” “Scientists” should be replaced with references to scientific studies and note that studies start in the 1800s. The traceable account for Key Message 3.3 states “Because of the widespread agreement across generations of climate scientists that the local climate change response in a particular variable can differ substantially from the globally averaged response in that same variable since the earliest climate change assessments, there is very high confidence in this statement.” Per the confidence/likelihood language definitions presented in the Front Matter, the widespread agreement in the entire available knowledge base, not scientists, should determine the confidence intervals.

Third, traceable accounts should include many citations and can be more technical. For example, in the traceable account for Key Message 3.1, the paragraph on the methane sources (page 3-34, lines 22-29) does not include any citations. Traceable accounts on major uncertainties in regional variability (page 3-38, lines 27-35) should also include citations. Traceable accounts for Key Messages 3.8 and 3.9 do not include many citations. Traceable accounts should use the references in the body of the chapter to explain the evidence for the statements made in the key messages. Notably, because the traceable accounts are intended to be more technical than the body of the text, the traceable accounts are a good place to present many of the complexities and caveats that currently make sections of the text difficult for broad audiences.

Likelihood statements should be consistently used where quantitative evidence exists to support statements. For example, the description of confidence in Key Message 3.1 only mentions confidence for anthropogenic warming, when likelihoods are available from the literature. The traceable account for Key Message 3.2 also does not include likelihood, although well-vetted likelihoods are available from the IPCC. Most of the key messages in this chapter could include likelihoods and provide supporting evidence for the likelihood statement in the corresponding traceable account.

In the traceable account for Key Messages 3.4 and 3.5, it is not clear that it is necessary to say that there are new scenarios and large ensembles exist and are useful. The traceable accounts section could be reduced to focus on the parts of the chapter that have confidence and likelihoods that impact hazards.

The traceable accounts for Key Messages 3.2, 3.6, 3.11, and 3.12 are good examples and consistent with the recommended method; however, the key messages do not include likelihood statements. The traceable accounts for Key Message 3.8 should be similar in scope as the other traceable accounts. The key gaps section is informative but lacks citations.

Comments on Graphics and Boxes

Overall, the graphics are clear and well chosen. Most of the figure captions should be expanded; all figure captions should be self-contained and explain where the information comes from, rather than just provide a citation. Additionally, chapter authors should make sure that each figure is referenced in the text, and there are opportunities to better integrate figures into the supporting text.

It is not clear why there is an elephant in Figure 3.3. The figure appears to be taken from a PowerPoint slide. Consider cropping and moving the text to the caption so that the actual data presented is easier to read.

Figure 3.4 is extremely similar (and should be identical) to Figure 2.4. Both figures may not be needed.

Comments on Equity and Justice

Chapter 3 contains no reference to equity and justice. The introduction to this chapter should discuss the importance of hazards from climate change and how they might adversely affect already overburdened communities more than others. Some of the topics, especially regional changes and short-lived climate forcers, could be framed through an equity and justice lens.

Comments on Data and Analyses

Overall, the chapter does a good job of describing data and analyses in a consistent way. All the figures should have figure captions that are more thorough so that they are self-contained and clearly state what the figure means and why the reader should care.

Comments on Literature Cited

Overall, appropriate literature is cited. In some places, more citations should be included. Details are included in Appendix A.

CHAPTER 4: WATER**Summary**

Overall, the chapter meets the requirements of Section 106 of the GCRA, with exception of the requirement of special attention to projected changes and challenges 25 to 100 years in the future. The chapter covers an admirably wide range of water topics. However, the chapter neglects to discuss or at least make clear ties to several key issues and chapters: mitigation (despite important carbon footprints of water management), blue carbon, energy (beyond hydropower), human health, economics, urban water, transportation, and agriculture. The key findings are reasonably well stated and supported (with some exceptions discussed below) and the subject matter covered within each key message follows a logical order. However, the key message titles should be rephrased into short, informative statements (see examples below),

rather than headers, to more clearly portray the key message. Additionally, the traceable accounts do not document the key findings in a consistent, transparent, and credible way and require significant revisions.

The chapter is, in parts, written at too high a technical level. For instance, the explanatory text should include more references to “climate change.” The reader is sometimes required to assume or infer that phenomena listed are due to climate change, which may be confusing for broad audiences, as defined in Chapter 2 of this review.

The chapter also tends to focus only on “bad news,” even where the figures themselves illustrate broad regions where some areas may fare better than others. For example, Figure 4.3 shows broad swaths of the US where precipitation changes are projected to be small, and Figures 4.6 and 4.7 show a swath of the desert Southwest where increases in soil moisture and runoff are expected. Even-handedness in NCA5 will be necessary for credibility and to provide a basis for realistic adaptation planning. Therefore, where relevant, this chapter should address both the many challenges posed by climate change as well as opportunities (see Chapter 29 [Alaska] for examples) or areas where climate change may have the least impact. There is somewhat uneven attention to the inclusion of both confidence and likelihood levels for many statements, with only one or the other or neither listed for many statements.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

Notably, the introduction is a summary of the chapter, though not necessarily with the same citations or emphases. It does not attempt to motivate the chapter (e.g., “we all need water”), nor does it set the stage for the chapter by discussing the state of knowledge in NCA4. A revision to at least touch on both of those introductory topics would benefit readers of this chapter. References to NCA4 should be used in this introduction and liberally throughout the chapter to better focus on knowledge gains since the previous NCA.

Comments on Key Messages, Supporting Information, and Traceable Accounts

The three key messages in this chapter reflect current knowledge about observed and projected impacts of climate change to water in the United States, followed by the challenges, opportunities, and methods to prepare for and address these impacts. They also identify emerging issues related to climate change. To help emphasize the key messages, the Committee suggests rewriting the titles as statements, rather than phrases, consistent with recommendations outlined in Chapter 2 of this report.

The text is written in a technical manner that, for the most part, communicates its findings effectively. However, some revisions may be needed to ensure comprehension by broad audiences. For example, “increasing the rates at which water is transferred to the atmosphere from open water, soil, and plants (Key Message 4.1)” is an unnecessarily opaque way of referencing what broad audiences will better understand as “increasing evaporation (and water use by plants).” As another example, in Key Message 4.2, “frontline of climate change” is a bit vague and might be replaced by “(particularly) vulnerable.” Beyond vocabulary, context needed by broad audiences is often missing—for example, the evapotranspiration (ET) discussion lacks

a relevant explanation. While it is helpful that ET is defined and climate impacts are discussed, the topic is missing the “so what” factor. Why should one care about ET when climate is discussed? Is ET good or bad? The chapter should not leave these questions up for interpretation, but instead ensure the text is clear and explanatory.

Adaptation and, especially, mitigation should be more fully discussed, specifically regarding water management (e.g., in Key Message 4.3). Adding a few sentences, along with references to other chapters where these issues are addressed more fully, might be all the chapter needs to introduce these important questions that policy makers are grappling with.

Comments on Specific Key Message Language

Key Message 4.1. Profound Changes to the Water Cycle

Climate change has caused profound shifts in the water cycle, creating risks for both people and nature (*high confidence*). Many regions of the United States are expected to see more precipitation and heavier rainfall (*likely, medium confidence*), resulting in increasing flood damage. However, warming will also increase the rates at which water is transferred to the atmosphere from open water, soil, and plants, increasing aridity and drought risk and threatening surface and groundwater supplies (*very likely, high confidence*). In many locations, snow cover is decreasing and melting earlier (*very likely, high confidence*), posing risks to agriculture and municipal water supplies, and natural systems (*high confidence*).

Suggested title: “The Water Cycle Is Changing, and Will Change, Profoundly.”

This key message provides a quick and generally readable synopsis of the range of water-cycle changes projected in terms of which water-cycle components will change or have already experienced change. The key message itself switches between changes already experienced (first sentence), projected changes (second and third sentences), and changes already experienced (fourth sentence), which weakens its impact. In each case (precipitation, evaporation, and snow), changes are already being experienced and are projected to increase, and the Committee suggests stating it as such.

The chapter opens with an infographic describing climate change threats to water quality. However, the key message does not touch on many of the issues presented nor does the supporting text.

Key Message 4.2. Rising Risks, Disproportionate Impacts

Natural and human systems have evolved under the water cycle’s historical patterns and cannot adapt quickly to rapid changes in patterns of droughts and floods (*high confidence*). Communities on the frontline of climate change—including many Black, Hispanic, tribal, Indigenous, and socioeconomically disadvantaged communities—are particularly at risk from changes to water quantity and quality due to the proximity of their homes and workplaces to hazards, limited access to resources and infrastructure, and cultural connections to water (*very likely, high confidence*).

Suggested title: “Water Changes Will Cause Different Impacts on Different Communities.”

This key message and its supporting discussion move immediately from the natural science focus of Key Message 4.1 to important issues of equity and justice disparities. Thus, this key message and its supporting discussion interject the issue of equity and justice disparities right from the start, elevating equity and justice issues. Notably, a reader could conclude from the wording of this key message that only the vulnerable and historically overburdened communities are at risk; the Committee suggests adding a few words in the first sentence to clarify that everyone will be impacted, but (second sentence) these communities face enhanced risks. Sanders et al. (2023) could be added as a reference to support this latter point.

Additionally, the first statement in the key message regarding the inability of human systems to adapt quickly to rapid changes in floods and droughts is an overstatement, belied by a hundred years of water-resources and flood-management activities. It is also likely contradicted by Indigenous knowledges. The Committee suggests the phrasing “struggle to adapt quickly” instead of “cannot adapt quickly.” As in Key Message 4.1, more attention to historical experience and responses to variability and extremes context in the supporting text would be useful for tempering or supporting this first sentence.

Key Message 4.3. Slow Progress Toward Adaptation

The ability of water managers to adapt to changes has improved with better data, advances in decision-making, and steps toward cooperation. However, infrastructure standards and water allocation institutions have been slow to adapt (*high confidence*), and efforts are confounded by wet and dry cycles driven by natural climate variability (*high confidence*). Frontline, tribal, and Indigenous communities are heavily impacted but lack resources to adapt effectively, and they are not fully represented in decision-making (*high confidence*).

Suggested title: “Progress Toward Adaptation Has Been Slow.”

This key message is well written and referenced, albeit limited somewhat by a few successful experiences thus far in overcoming barriers to planning and limited implementation of major adaptations. Both this key message and Key Message 4.2 highlight the observation that “adaptation is slow,” but it is unclear how this is measured. The Committee suggests providing an explanation for how adaptation is being measured either in the key message or in the traceable accounts. Also, Chapter 31 (Adaptation) should be referenced here for more detailed considerations of adaptation.

Comments on Text Supporting Key Messages

Key Message 4.1. Profound Changes to the Water Cycle. *Nuances of the projected changes often neglected:* Broadly speaking, the supporting discussion tends to list changes and impacts in geographically overbroad terms. For example, “many regions expected to see more precipitation” directly ignores the 25 to 30 percent of the country where declines are projected (Figure 4.3); the Committee suggests that slight wording changes such as “northern and eastern states will see more precipitation and southern states will see less” would make these statements more accurate and effective. Additionally, more significant rewording or cross-referencing relevant chapters would highlight more of the nuances or regional differences rather than implying that single projection applies to all regions equally. The overbroad descriptions also tend to discuss only the ensemble-means of projections (in Figures 4.3, 4.4, 4.5, 4.6, 4.7, and 4.9)

with no mentions of the ranges of outcomes indicated by the upper and lower percentile maps for each water-cycle variable shown in these same figures. If space allows, it would be helpful to include a discussion of these ranges in the supporting discussion for Key Message 4.1; at the very least, these ranges should be discussed in the corresponding traceable accounts. The Committee also suggests replacing “means” with “averages” throughout the chapter to enhance accessibility, and if medians are being used, they should include a brief explanation. Finally, it would be helpful throughout to clarify which changes (historical or projected) are precipitation-driven versus temperature-driven; uncertainties are larger regarding the former than the latter.

Reports of observed changes versus reporting of projected changes are intermingled and confusing: In several places—for example, the paragraph at top of page 4-12—the text switches between references to projections and already-observed changes in ways that confuse the audiences; more care should be given to distinguish the time frames (now or future) and basis (observations versus model projections) of the changes discussed throughout. Similarly, clarification of the distinction between projected climate changes (i.e., changes in climate) versus changes in terrestrial parts of the water cycle (i.e., groundwater recharge) induced by climate change would be useful.

Climate and water-cycle variability almost entirely neglected: This key message and supporting discussion largely neglects to mention either the natural variability that the trending and projected changes are embedded in, or the projections that variability is in many cases, projected to increase. Both aspects of variability are important context for interpreting the past and future changes reported and for understanding their likely practical impacts.

Flood non-stationarity treated as an “open question”: The large uncertainty suggested on page 4-11, lines 5-7, is either an overstatement of the cited work in the face of scientific consensus or is not accurately summarized. There is little doubt or lack of consensus that historical records of floods are an increasingly unreliable representation of current or future probabilities and magnitudes under climate change. The Committee suggests clarifying the meaning or the literature basis for this conclusion and bringing this statement and the key message assertion that there are major changes in flood damages to come into better agreement. The key message also frames its projection of increased flood “damages” in a way that appears to attribute that increase strictly to heavier precipitation. Flood damages, however, will depend on the success or failure of flood-risk management provisions and adaptations; flood risks are projected to increase in many places, but that is not the same as flood damages. Even flood risks are not entirely determined by the fate of heavy precipitation. Conversion of precipitation from snowfall to rainfall, increased durations and numbers of storms, and other non-climatic changes may contribute as much to increased flood risks and increased droughts as precipitation does. Additionally, the general tendencies of landscape drying may reduce flood risks in some locales. The Committee suggests that more care be given to connecting how the precipitation change projections translate to flood risks and then eventually to flood damages.

Changes in duration of extremes not mentioned: Future storms (and droughts) are described in terms of increasing frequencies and magnitudes; changes in storm durations are also projected and will have equally significant impacts (e.g., Gutmann et al., 2018; Kossin, 2018; Lamjiri et al., 2017; van Oldenborgh et al., 2018). In many settings, it is the duration that increases mortality (in the case of heat waves) or results in the largest precipitation totals. More discussion of drought durations and even multiple drought types might be warranted in this discussion.

Key Message 4.2. Rising Risks, Disproportionate Impacts. *Limited attention to causes and consequences of disparities:* As noted in the discussion of equity and justice issues below, this section rarely progresses beyond acknowledging that certain communities will be worse off and focuses even less on why and how to address the disparities than the key message itself. In this regard, the key message and this discussion should be brought into better agreement.

Current Colorado River issues provide useful examples that could be included here: This section should also include a discussion of drought-stricken Colorado River basin areas and tribes with water rights that have yet to be quantified as pressing examples of impacts and disparities. The issue of past (natural) megadroughts (most pressingly, in the Colorado River basin) is extremely important in a key message addressing extremes and impacts, and the discussion (e.g., on page 4-16) should explicitly point at the later discussion around Figure 4.19 or move the discussion and figure up to this key message, or even Key Message 4.1.

Key Message 4.3. Slow Progress Toward Adaptation. *Discussion of water disputes is oversimplified:* Not all water disputes are handled with litigation; this suggestion (page 4-21) is overly simplistic. It is especially not accurate when the statement is followed up with a statement about the Colorado River. The Colorado River has had many legal tools used to allocate water; this body of law is known as “the Law of the River” and is largely made up of a combination of agreements between states, nations, and smaller entities. It is true that climate change has stressed the capacity of the Law of the River to work as intended and there are problems with the body of law as well. For example, tribal rights to the water have, in several cases, not been quantified. The Law of the River was designed to provide and allocate water using assumptions based on pre-industrial times when flows were above average and tribal rights were unaccounted for. Now, given the historic megadrought-induced water shortages and snowpack reductions, the system is stressed and is in rapid and continuing decline. A more accurate sentence here might read (see suggested citation, Garofalo, 2019):

Climate change impacts to water supplies can result in competition, collaboration, or conflict. Tools may include litigation, administrative proceedings, treaty negotiations, compacts, and/or cooperative agreements, among others. Under current severe drought conditions, water rights holders in the Colorado River Basin, including Mexico, tribal nations, states, and other interested parties are struggling to adapt under the existing legal framework—one that was mistakenly based on the assumption of continued sustained flows and on an above average historic estimate of total water available to apportion. While some of these efforts include tribes....

Natural variability context scarcely mentioned until end of chapter: The discussion of natural variability in context of the Colorado River Compact (page 4-23) is an important addition but appears very late in the long list of chapter-specific trends. The final sentence (page 4-23, lines 17-19), with its allusion to the crucial mix between natural variability of “wetness” versus warming-induced flow reductions, is a key problem that was ignored throughout the earlier parts of the chapter and that will be faced in most parts of the country. The Committee suggests the chapter authors highlight and expand on this issue earlier under either Key Message 4.1 or Key Message 4.2.

Other equity- and justice-impacted communities are largely ignored: The subsection on tribal and Indigenous communities (page 4-25) is a good start, albeit drawing mostly from a

single reference (Fillmore and Singletary, 2021). As noted below, this use of a separate subsection to address these issues means that tribal issues that are shared by other nontribal communities are highlighted, which is laudable, but without acknowledgment of issues and barriers shared by other communities.

Water quality issues under-addressed: The finding (from Fillmore and Singletary, 2021) that water quality information is the most pressing need (page 4-25, line 5) among the western tribes they polled suggests that perhaps more discussion and attention to water quality issues, following Figure 4-2, is in order in the chapter.

Lack of technical capacity is the real limitation on adaptation: The lack of access to downscaled projections on page 4-25, lines 19-20, is less of an issue since past NCAs with the advent of high-resolution national coverage and modern internet resources in most areas; it is not the case that such projections are “rarely” available now or are the limiting factor on adaptation planning and activities (Findlater et al., 2021). What is insufficiently available now are the technical skills, expertise, and computing resources necessary to put those available projections to use in non-research institutions. Furthermore, rather than access, there is a lack of consistent guidance on whether and how projections should be incorporated into planning.

Comments on Traceable Accounts

The Chapter 4 (Water) traceable accounts do not include citations. Additionally, the traceable accounts make some stronger and different assertions, and express more confidence in some instances, than the text in the body of the chapter. Additionally, the purpose of traceable accounts is to support *how* the authors arrived at their confidence and likelihood statements. While the traceable accounts are well written, they *should include* citations to adequately support the claims made in the text. Because the traceable accounts are lacking citations, the chapter does not identify and provide sufficient context for embedded content in the traceable accounts section. Thus, the traceable accounts should be revised to demonstrate *which* references support *each* confidence and likelihood statement.

As noted above, water quality, especially the mechanisms by which it will be affected by climate change, is neglected in this chapter. Figure 4.2 nicely summarizes many of these mechanisms, but this figure is inadequately discussed and only referenced in passing in the chapter. Some of this missing attention to water quality may reflect the relatively thin literature on the topic, but this relative lack of research on water quality with relevance to the impacts of climate change should be highlighted in the traceable accounts.

The summary (on page 4-9) of projected western United States groundwater-recharge changes, “decreas(ing) natural recharge across much of the West,” which is stated without a confidence level, is an inaccurate depiction of the projections. The statement is contradicted by the key figure (6) in the primary citation (Niraulta et al., 2017), which shows different outcomes in different regions, over different time frames, and from different climate models. Thus, confidence should be relatively modest at present, indicating that this is an important research gap.

The list of ways that warming will influence snow processes and implied snow-fed runoff processes is missing one of the more important and straightforward changes to come: the fractions of many historically snow-dominated river basins that receive rainfall (and generate rapid rainfall runoff in large amounts) instead of snowfall will increase dramatically, thus increasing the flood flows and early runoff. The regions that will be impacted are more pressing

than the changes in rates and frequencies of rainfall versus snowfall in determining these enhanced volumes of runoff and winter floods.

Finally, regarding the continued discussion of snow processes on page 4-27, several important articles should be included (also in Key Message 4.1) to bring this discussion up to date: the excellent up-to-date literature review by Siirila-Woodburn et al. (2021), and a wide-ranging evaluation of snowmelt sensitivities by Ban and Lettenmaier (2022), Gordon et al. (2022), and Harpold and Brooks (2018).

Comments on Graphics and Boxes

The figures are generally effective and appropriate. For the most part they are simple, captioned well, and useful to wide audiences. In most cases, though, the figures should be better integrated into the body of the text (as most are dispatched therein with a single sentence each or less) to further motivate or expand on points made in the text. The Committee highlights more specific suggestions below.

Figure 4.2 is an effective and accessible infographic that presents primary pathways by which climate can impact water quality. If possible, the Committee suggests constructing a corresponding infographic for water quantity and/or supply.

Figures 4.3, 4.4, 4.5, 4.6, 4.7, and 4.9 are an excellent sequence of similarly formatted graphics showing projected midcentury ensemble mean, 20th percentile, and 80th percentile changes in various water-cycle components. The captions include a wide range of useful “examples” but are stated strictly in terms of Representative Concentration Pathway (RCP) 4.5 conditions. However, this is inconsistent with what the map labeling implies is shown in the maps. Additionally, the text states, “average of all projections” and “average of 10 projections,” but does not define how many are included in the “all” referenced. The Committee suggests fixing the labeling or the captions to make sure they are aligned.

Figures should be able to stand alone, and the captions should both tell the reader the meaning of the figures and describe what the figures show. The ensemble-average projections are covered in the text but treated as the projections; it would be better to acknowledge and at least allude to the ranges of changes indicated by the 20th and 80th percentiles shown. (In the caption of Figure 4.4, “the projections ... are expected to decrease” is an odd and redundant phrasing.)

Comments on Equity and Justice

The authors include some attention to equity and justice in the chapter; however, it would benefit from stronger framing of equity- and justice-related issues in the introduction, including a definition of water justice. The Committee also suggests integrating historical and systemic drivers of preexisting inequalities that may be entrenched or exacerbated by climate change (i.e., describe how the changes to water quality, accessibility, reliability, and availability are related to the social context of water justice (i.e., resource distribution, decision-making dynamics, power relations). The Committee appreciates the attention to the importance of data access.

Currently, the chapter authors focus primarily on Black, Hispanic, tribal, Indigenous, and socioeconomically disadvantaged communities, and occasionally on distinctions between rural and urban communities and settings. Key Message 4.2 could benefit from a discussion on the disproportionate impacts to drought-stricken Colorado River basin areas and tribes with water

rights that have yet to be quantified. Additionally, many of the discussions of equity and justice issues would be improved by pointing to other chapters and sections where the issues are more fully addressed.

Notably, there is no mention of gender issues regarding water availability, despite the glaring fact that, from as recently as the November 25, 2022, *Eos*: “according to the United Nations, climate change and its effects are not gender neutral: Women and girls are hit the hardest, as the climate crisis deepens already existing gender inequalities,” with even more acute disparities across the range of LGBTQ+ communities (e.g., Goldsmith and Bell, 2022; Goldsmith et al., 2022; Vinyeta et al., 2016). Pacific Island communities are also not mentioned in this chapter. In fact, the word Hawai‘i appears once, and only to explain that it is not in a specific image. There is no mention of equity issues likely associated with examples like Figure 4.14.

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible. Finally, specific gaps in equity- and justice-related literature with respect to the chapter focus should be noted.

Comments on Data and Analyses

The chapter summarizes existing literature rather than employing data and statistics, and so few comments on data and analyses are applicable.

Figures 4.3, 4.4, 4.5, 4.6, 4.7, and 4.9 map ensemble average and 20th/80th percentile projected changes in selected water-cycle variables. Unfortunately, only the average changes are discussed and sometimes in the context of projected outcomes. The ranges of projections indicated by the 20th and 80th percentile maps should be incorporated into the discussions, and into the uncertainties and likelihoods as described in the chapter.

Comments on Literature Cited

Many references cited throughout this chapter are older than ten years and thus predate NCA4. Where possible, older references should be replaced with newer literature, or, better still, selective lists of references building from the earlier reference should be used to demonstrate the growing body of literature on the topic. Additionally, much of the discussion and literature cited is noticeably western US-oriented, and additional newer references for eastern US issues should be included.

Occasionally, the literature cited does not reflect as broad a statement as it is cited to support; examples are offered above (e.g., the use of the Niraulta et al., 2017 paper in Key Message 4.1) and in Appendix A. Another example is from the discussion on drought (page 4-17, lines 14-16): “Drought conditions have historically resulted in increased groundwater pumping, a practice projected to increase with climate change (Bloomfield 2019; Hanson et al. 2012; Scanlon et al. 2012).” The Bloomfield article is based on case studies in the United Kingdom and the other references are focused on specific regions, rather than the United States as a whole. The chapter should reflect this nuance in its summary of the literature.

CHAPTER 5: ENERGY SUPPLY, DELIVERY, AND DEMAND

Summary

The Committee found Chapter 5 (Energy Supply, Delivery, and Demand) to be strong overall. The chapter largely meets the requirements of Section 106 of the GCRA. The key messages are clearly stated and are thoroughly supported by the detail provided within the chapter, and the findings are mostly documented in a consistent, transparent, and credible way. However, the traceable accounts require revisions to include citations and more details about how and why confidence and likelihood were determined based on the knowledge base. The chapter could also better integrate issues of equity and justice inherent in the US energy system. Additionally, the chapter does contain some technical language that may be difficult for the broadest possible audiences to follow; however, this is hard to avoid and still maintain clarity and accuracy for a technical topic like energy. The Committee provides suggested additions for topics and citations below.

The standout advancements in energy since NCA4 include improvements in clean and smart energy technology deployment, progress in climate modeling and planning methodologies, and increased equitable access to clean energy. These are clearly noted by the authors. However, reductions in coal use in the United States since NCA4 deserve mention as well.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

Although the introductory text provides appropriate context, the Committee has three suggestions for additional context that could be added. First, chapter authors could consider discussing energy subsidies and other relevant government interventions including the recently passed Bipartisan Infrastructure Law and Inflation Reduction Act, mentioned in two other chapters (Chapters 25 [Northern Great Plains] and 32 [Mitigation]). Another important development is the use of litigation, particularly against the fossil fuel industry (Setzer and Higham, 2021). Similarly, natural gas bans in cities and bans on electricity produced with coal by some states (e.g., California, Oregon) should also be mentioned (Stevens and Lamberrmont, 2021). Second, the introduction should mention fossil fuels by name and relevant expectations for the fossil fuel industry such as reducing methane leakage/venting. Third, the chapter would benefit from a discussion of international topics related to energy such as the global energy supply chain and a more pointed discussion of critical minerals and supply chain concerns, as these topics are important in the context of both climate change and global change. Other international tensions relevant to US energy worth mentioning include nuclear energy (e.g., instability of Russian reactors); use and international trade of coal (i.e., among the United States, Germany, China, and Russia); production, demand, and trade of natural gas and oil; and imports, exports, and scaling up of solar panels. Topics not included in the chapter should also be mentioned in the introduction.

Comments on Key Messages, Supporting Information, and Traceable Accounts

The key messages in this chapter reflect the current knowledge base of observed and projected impacts on energy systems in the United States as well as the challenges, opportunities, and ways to address the risk in the energy systems. The key messages are written in a consistent and appropriate way and reflect supporting evidence well. However, it is not always clear to which clauses of individual sentences the confidence and likelihood rankings apply. To provide credibility, it is important that each assertion includes a confidence and, if applicable, likelihood ranking (see Key Message 25.1 for an example). The chapter prioritizes newer literature (since NCA4) and appropriately includes citations after each assertion.

Overall, the label, title, and message for each key message are appropriate, and consistently use both confidence and likelihood language. Key Message 5.3 should convey whether current progress is sufficient to address the current and future impacts of climate change.

Comments on Specific Key Message Language**Key Message 5.1. Climate Change Threatens Energy Systems**

Energy supply and delivery are at risk from climate-driven changes, which are also shifting demand (*likely, high confidence*). Effects on energy systems are expected to increase with projected increases in the frequency, intensity, duration, and variability of extreme weather events (*likely, high confidence*). Potential impacts include damages to infrastructure and operations and resulting effects on human lives and livelihoods from extreme precipitation, extreme temperatures, sea-level rise, and more intense storms, droughts, and wildfires (*likely, high confidence*).

Key Message 5.1 summarizes the observed and projected impacts and disruptions on energy systems including energy supply, energy delivery, and energy demand. The key message is concise, appropriate, and consistently uses assessments of both confidence and likelihood. In the text supporting the key message, there are great examples and citations throughout, including noting positive impacts of climate change (e.g., Alaska offshore production). The citations and logical order of topics support the confidence and likelihood statements.

Key Message 5.2. Compounding Factors Affect Energy System and Community Vulnerabilities

Interconnected effects of changes in technologies, policies, and markets increase the potential vulnerabilities of energy systems and communities to climate change and extreme weather (*likely, high confidence*). Compounding and cascading hazards related to energy systems and additional stressors such as cyberthreats and pandemics create risks for all but disproportionately affect underserved and overburdened communities (*likely, high confidence*).

Key Message 5.2 summarizes the observed and projected impacts from compounding factors such as resource constraints (material and workforce, supply chain, siting new infrastructure), cybersecurity threats to the power grid, vulnerable communities and equity, and cascading hazards. The title of this key message is informative, the message is well written, and

the topics discussed flow logically. In the text supporting the key message, citations are recent and support the overall findings (confidence and likelihood statements). Terms are defined in the text where necessary to help all readers understand.

Key Message 5.3. Progress Continues on Enhancing Energy System Resilience

Investments are being made to increase the resilience of the energy system, and opportunities exist to build upon these efforts (*likely, high confidence*). Progress includes improvements in energy-efficient buildings; technology to decarbonize the energy system; advanced automation and communication and artificial intelligence technologies to optimize operations; climate modeling and planning methodologies; and efforts to increase equitable access to clean energy (*likely, high confidence*). An energy system transition emphasizing decarbonization and electrification would require significant investment in new generation, transmission, distribution, and fuel delivery (*likely, high confidence*).

Suggested title: “Efforts to Build Energy System Resilience Are Under Way.”

Key Message 5.3 summarizes the existing investments to increase the resilience of the energy system and highlights the opportunities to further strengthen these efforts and resilience. The analysis is supported by recent literature. However, the term “resilience” given its central role in this key message should be clearly defined. Additionally, this key message should also indicate whether current progress and trajectories are sufficient to enhance energy system resilience to deal with future potential damages from climate change. The Committee suggests the key message title not use “continues on,” which is not clear. The Committee provides a suggestion for an alternative title above. Lastly, the second sentence includes many claims, and it is unclear if the confidence and likelihood statement pertains to only some or all of these claims.

Comments on Text Supporting the Key Messages

Key Message 5.1. Climate Change Threatens Energy Systems. This chapter describes several impacts of climate change on the United States energy system, but it omits how the total demand for energy could change. There is a detailed analysis of the electricity system but there are not similar details for “primary” energy resources like coal, oil, and gas demand.

The key message is about climate change but most of the examples are about the effects of weather and weather-driven events like wildfires under current conditions (or projections) without a clear message about changes in recent decades. This key message is also missing the distinction between natural variability and climate changes; clarity could be added by modifying a few sentences throughout the chapter. Examples could be more clearly communicated by discussing them separately from the projections as well as by creating an additional section for examples associated with climate change. Permafrost impacts in Alaska are not discussed, including issues like methane leakage, a key challenge in the oil and gas industry.

The text supporting this key message should also note the impact of policy responses to climate change on the energy system. An example could be price changes due to imposing a price on carbon, or higher overall energy costs as the infrastructure and makeup of the energy system changes. The Committee suggests adding a discussion about what oil and gas are used for besides electricity to clarify that even in a “transitioned” world their development and delivery is still relevant, and therefore the inclusion here makes sense to audiences. It is also important to

note where regional differences exist across the country—for example, electricity generation and water availability is a topic that may be more relevant in the west and mountain west than in the east—and there should be cross-references to those relevant regional chapters. Given limitations of the word count, the Committee suggests that the technical details for the section of “Oil and Gas Delivery” be moved to the traceable accounts.

Key Message 5.2. Compounding Factors Affect Energy System and Community Vulnerabilities. Regarding vulnerable communities and equity, there is a lack of discussion about the distributional impact to those who used to work in the traditional fossil fuel sector but have been displaced due to the energy transition. Other compounding factors that are missing include inflation and geopolitics, which can impact energy prices. The Committee suggests adding cross-references to other chapters (e.g., Chapter 19 [Economics]). In addition, consumer behaviors are not discussed, which may impact the adoption of new energy technologies and influence the actual performance of these technologies. The text supporting Key Message 5.2 may be slightly technical for broad audiences, so the Committee suggests defining terms specific to the energy industry in the introduction. This section is also an important opportunity to note the emerging evidence that CO₂ affects human cognition at levels observed in buildings in cities, including school classrooms (Du et al., 2020; Karnauskas et al., 2020; Wang et al., 2021). This addition may not involve much text, but instead could mention the topic and reference Chapter 15 (Human Health). The impact of CO₂ on human cognition levels has been missed in previous reviews and even in IPCC AR6.

Additionally, the Committee suggests touching on the causes of resource constraints, particularly regarding the critical minerals supply chain and the implications for the energy sector (Ballinger et al., 2019; Li et al., 2020). The section could also use more detail and citations. Similar comments are made in Chapter 32 (Mitigation) review, and therefore, there may be an opportunity for both of these chapters to cross-reference one another on this topic rather than duplicating information, which should help minimize the number of additional words. Given limitations of the word count, the Committee also suggests that the technical details for the section “Compounding and Cascading Hazards” can be moved to the traceable accounts.

Key Message 5.3. Progress Continues on Enhancing Energy System Resilience. Reductions in coal use in this country since NCA4 deserves mention. It is a great story of mitigation in action but should be couched in the context of the fuel switching driven by natural gas price advantage and not just renewables. Related issues of equity and their effects on communities deserve attention as does the differing approaches of states (e.g., Righetti and Stoellinger, 2021). The text in this section would also benefit from adding a few sentences detailing the Inflation Reduction Act changes to the tax credit scheme that emphasize worker protections and vulnerable population protections. The short discussion of energy storage in this section omits developments of alternative materials beyond lithium. Similarly, the idea of recycling battery materials or the circular economy should be explored. Given the limitations of the word count, the Committee suggests that the technical details for the section “Automation, Information Technologies, and Grid-interactive Efficient Buildings” can be moved to the traceable accounts.

Comments on Traceable Accounts

Generally, the chapter does a decent job in its traceable accounts section. Literature citations are highly variable, and the Committee suggests consistently adding citations after

sentences that assert that there is literature, policy, or law supporting a claim. For example, the statement, “The impact of climate change on global warming and sea-level rise is well established in the peer-reviewed research and supporting publications...” (page 5-19, lines 28-29) should include references. Overall, literature citations are lacking in the traceable account for Key Message 5.1, rare for Key Message 5.2, not uncommon in Key Message 5.3. This is primarily an issue in the “Description of the Evidence” sections for each key message. Adding appropriate citations would help appropriately identify and provide sufficient context for the embedded content.

The traceable account for Key Message 5.2 is quite long, though it is effective in describing the omissions in the literature and the lack of available data due to classified information. The traceable account for Key Message 5.3 should describe how authors arrived at their prescribed likelihood statements, as is done for the other key messages.

Comments on Graphics and Boxes

The graphics are effective and appropriate but could be better integrated into the text. Some are too busy and try to do too much without enough explanation in the captions, making them somewhat inaccessible. Specific suggestions are described below.

The title of Figure 5.1 is different than the title embedded in the image. The Committee suggests making them the same or omitting one. Additionally, the text in the small boxes is hard to read and there are too many boxes, which is distracting. The Committee suggests reducing words if possible or organizing the text in a table under the image with numbers to identify where the “pipelines,” “thermoelectric power plants,” etc. appear in the image. Figure 5.1 should also be updated to reflect permafrost changes, such as on pipelines.

For Figure 5.2, the Committee suggests using “electricity demand” instead of “energy demand” in the titles because this figure is only about electricity. Authors should also clarify the word “hot” in the figure where it describes the scenario.

In Figure 5.7, the Committee suggests explaining in the caption the difference between the two images, and why the “renewable” electricity generation graph (b) shows coal—is it biofuels and carbon capture utilization and storage?

Comments on Equity and Justice

Equity and justice principles are somewhat addressed throughout the chapter, however, given the inherent environmental injustices in the energy sector, the chapter should more clearly emphasize these principles. Below, the Committee identifies several equity and justice issues that could be expanded or discussed to enhance the chapter.

The chapter would benefit from defining “energy justice,” including distributional (distribution of benefits and burdens across populations), procedural (who is included in energy decision-making processes to ensure that energy procedures are fair, equitable, and inclusive), and contextual (understanding of historic and ongoing inequalities) aspects. The key energy justice-related terms should be integrated, including energy insecurity, energy burden, energy equity, heat equity, and just transition. There are additional equity and justice issues relevant to this chapter. For example, in the context of energy, race is the primary indicator for the placement of toxic facilities in the United States (Mohai and Saha, 2015). The chapter should

also include a discussion on energy lifecycles as they relate to environmental justice, including extraction, production, consumption, and waste.

The chapter lacks an important discussion on energy industry workers who have based their generational livelihoods on fossil industries (e.g., coal and mining industries) and will likely face a lack of work or the need for training to move into new industries or technologies. A related discussion of public acceptance could be included (e.g., Armstrong, 2021; Sharpton et al., 2020). The issue of how expertise in the oil and gas community is relevant to many challenges in the renewable energy sector is not explored. Considerations of the workforce are the intertwined health issues. The Inflation Reduction Act emphasizes worker and vulnerable populations protections through a new two-tiered tax credit system that could be mentioned in Key Message 5.3. There should also be a discussion of inequitable adoption of new energy technologies among groups of consumers (e.g., adoption mainly happens in wealthy neighborhoods).

More focus is needed on the just transition literature and related equity complications. For example, there should be a discussion on the transition to lower-carbon sources of energy without specific efforts to ensure an equitable transition; as a result, everyone will not benefit equally (Carley and Konisky, 2020). Also, the chapter could mention that frontline communities of a just transition are diverse and, in addition to race and ethnicity, include those who work in legacy energy industries; non-extractive communities that rely on fossil fuels (i.e., those that host power plants or manufacture combustion engines); those who face enhanced short-to medium-term energy insecurity; as well as those who will lack access to new employment opportunities, involvement in decision making, and advanced technologies.

Finally, there should be a review of efforts to address disparities and build adaptive capacity including workforce and economic development, energy assistance programs, access to technology, community engagement in decision-making processes, and identification of barriers to a just transition. Associated data gaps should also be pointed out, such as who is on the frontline of a just transition, as well as the effectiveness and design of technology access, workforce, and economic development programs.

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible. Finally, specific gaps in equity- and justice-related literature with respect to the chapter focus should be noted in the text or traceable accounts.

Comments on Literature Cited

This chapter cites literature from well-respected journals and agencies, most of which were published since NCA4. However, the Committee suggests also including other sources of information and literature that make up the knowledge base.

Other Recommended Changes

The Committee suggests discussing regulatory barriers that impede the commercial build-out of new technologies—for instance, the unclear regulatory framework for CO₂ or hydrogen pipelines (e.g., Garofalo and Lewis, 2020). This chapter is primarily focused on impacts on the energy systems and energy system resilience but lacks a detailed discussion on mitigation and adaptation moving into the future. The Committee suggests adding the role of mitigation

measures in addressing climate change to Key Message 5.3, as well as referencing Chapter 32 (Mitigation) where these efforts are discussed.

CHAPTER 6: LAND COVER AND LAND-USE CHANGE

Summary

This chapter reviews climate change impacts related to land cover and land-use change (LCLUC). The chapter is strong and essential for the framing of the broad objectives of NCA5 and meets the requirements of Section 106 of the GCRA but could be improved with a few key modifications. This chapter is important because LCLUC is an important element of global change research, though the chapter could more explicitly include projections of trends 25 to 100 years in the future. This chapter is written at an appropriate technical level, especially for decision makers, and supports an appropriate balance of evidence against scientific uncertainties. A chapter on LCLUC was also included in NCA4 and the chapter in the draft NCA5 report brings new materials, especially an interesting focus in Key Message 6.3 on constraints to the array of available land-use choices resulting from future land-based mitigation needs.

The chapter provides a working definition of land systems, which encompasses both land cover and land-use. However, the text frequently departs from a disciplined use of the definition in favor of generally referring to land-use or ecosystems. The chapter would benefit from a discussion that is explicitly framed around land cover and land-use. There is a focus on developed land as an important focal point, which is useful since this land cover class is less well addressed in other chapters. However, it is misleading to emphasize its importance by referencing its rate of increase, when in terms of total area change, developed land may be less important than other land cover changes, such as agriculture and forests. NCA4 suggested the developed land category is far less important than emphasized in this chapter. The precise analysis of LCLUC statistics should be reviewed here and cross-checked with other chapters. Similarly, estimates of emissions and removals should be reviewed, made consistent with other chapters, and standardized using an established source such as the US National Inventory (EPA, 2022). The chapter could be improved with additional text on rangelands and grasslands, particularly given their importance in NCA4. Revisions are needed to better integrate equity and justice into the chapter. The examination of future LCLUC projections is useful, but the chapter uses outdated Special Report on Emissions Scenarios (SRES) emissions scenarios. Lastly, the chapter could benefit from more reference to, and use of, emerging concepts and literature of land change science.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction presents several figures; however, it should also introduce the key message themes. It would also be useful to expand the discussion on the importance of LCLUC in analysis of climate change and climate change mitigation and adaptation. Other chapters note that climate change impacts are complicated and exacerbated by land management; it would be

appropriate in this chapter to go into more detail about the nuance interactions of climate change and LCLUC. There is an emerging field of land science with references that could be added (e.g., Chowdhury and Turner 2019; Gutman et al., 2004; Rindfuss et al., 2004; Turner et al., 2007, 2020). One potential area of discussion is the concept that LCLUC influences both the radiative aspects of climate change (i.e., GHG emissions and removals) and the water-energy balance through surface conditions change (i.e., albedo, latent and sensible heat flux). These dynamics and their interactions and feedbacks with climate are complex and not always obvious—for example, in some conditions, biotic carbon sequestration can lead to additional warming. It is important to distinguish this chapter on LCLUC from other chapters on forests, ecosystems, and agriculture, and by drawing on the land change science literature. Reference to, and drawing from, Chowdhury and Turner (2019) and Turner et al. (2007, 2020) may be useful.

Comments on Key Messages, Supporting Information, and Traceable Accounts

This chapter discusses climate change impacts on LCLUC. The chapter authors outline the definition of land systems, which is comprised of two components: land cover and the way land covers are used by humans, or land-use. The chapter does a good job outlining the importance of land systems because it generally covers the most important domains of impact as well as where most mitigation and adaptation will take place. Although the chapter introduction starts with a defined framework for analysis (i.e., land cover and land-use), the key messages and the discussion on potential future options for adaptation does not adhere to this framework. While the emphasis of this chapter is to examine climate change impacts on land cover, with a focus on domestic concerns, it would be useful to include a brief discussion of how land cover changes in turn drive climate change, such as when deforestation results in GHG emissions or changes in water or energy balance. Furthermore, briefly discussing the idea of global teleconnections between land cover changes in other parts of the world and climate change impacts here in the United States would provide the audiences a better understanding of the complexities of interactions between land cover and climate change. A good example of these teleconnections is the hydroclimatological teleconnection between deforestation in the Amazon and domestic climate change impacts. Among other facets, this would help give the audiences a better understanding of the global context for land cover change mitigation.

There are some early conceptualization issues as well—for example, representing important land cover changes based on percent change rather than absolute magnitude gives a false impression that expansion of developed land cover is most important, which is not accurate. The key messages are appropriate and presented in a logical way, especially Key Message 6.3 on future projections. However, it would also be useful to note that LCLUC is by itself an important global change, which will interact with climate change to exacerbate, or perhaps ameliorate, the impacts. This chapter focuses on climate change influences on infrastructure, which is a good message for audiences because of its obvious economic impact. Key Message 6.3 on restricting future decision options is very important, and perhaps could be given more emphasis overall. Key messages are often missing likelihood statements, and it is not clear that the chapter authors approached confidence and likelihood in the same way as other chapters, nor as specified in the Front Matter.

The chapter could be improved by adding more on grasslands, rangelands, and pastures concerning recent increases in fire. One of the dominant land covers in the United States, rangelands, has important climate impacts, such as fire and new evidence on invasive species

from climate change. Relatedly, there should be more discussion on the wildland-urban interface (as well as other land cover/land-use interfaces), which would help frame this chapter in a way that is distinct from other “land cover” chapters.

Similarly, with other chapters, land cover changes are driven by both climate change and natural variability, which should be attributed separately. Early in the discussion of Key Messages 6.1, there is a statement that the United States sink for carbon is dominated by increased CO₂ concentrations in the atmosphere over the influence of LCLUC. The next sentence cites Pugh et al. (2019), which comes to a different conclusion, unless the CO₂ fertilization influence on regrowth is taken into account. This idea contradicts Chapter 7 (Forests), which attributes the sink to harvested wood products and regrowth. All references to carbon budgets and GHG inventories should be reconciled, standardized, and consistent with current literature, common terminology, and other chapters. In addition, the chapter does not acknowledge the role of natural variability in the key messages. At local levels, natural variability may play a larger role than climate change.

Comments on Specific Key Message Language

Key Message 6.1. Land System Goods and Services

Climate change has increased the intensity and frequency of extreme rain, droughts, fires (*high confidence*), and floods (*low to medium confidence*), posing increased risks for roads and other infrastructure, agricultural production, forests and biodiversity, and human health (*high confidence*). The role of forestlands as carbon sinks is at risk from climate-driven wildfire (*high confidence*). Climate change has disrupted the ways that people interact with the landscape for spiritual practices, recreation, and subsistence (*high confidence*).

Suggested title: “Climate Change Will Increase the Threat to Infrastructure and Loss of Important Land-Based Goods and Services.”

In order to acknowledge the role of natural variability discussed above, Key Message 6.1 should include “in some places and times” to recognize that climate change does not cause these hazards everywhere, all the time.

Key Message 6.2. Land System Resilience

Resilience allows natural and built systems to maintain their basic character and functions in the face of change, supporting the continued delivery of goods and services. Changes in climate and land use affect the resilience of land ecosystems and thus the fate of the services they provide (*high confidence*); for example, increasing drought reduces the ability of forests to store carbon. Climate and land-use change interact, and these interactions present challenges as well as opportunities for maintaining ecosystem resilience (*high confidence*).

Suggested title: “The Combination of Climate Change and Land-Use Change Will Lower the Resilience of Land Systems to Floods, Droughts, and Other Challenges.”

Given that the term “resilience” plays a central role in this key message, the Committee suggests including a clear definition of the term.

Key Message 6.3. Future Land-Use Options

The future of land use in the United States will depend on how energy and agricultural technology evolves, how the climate changes, and the degree to which we prioritize climate mitigation and adaptation in land-use decisions (*very high confidence*). Continued crop yield improvements and reductions in demand for animal-sourced foods could free agricultural land for other uses, depending on the ability to maintain agricultural system resilience (*low confidence*). Decarbonization will require a large expansion of solar and wind energy generation and transmission infrastructure (*high confidence*) and may involve large land-use changes toward reforestation or biomass crop cultivation (*low confidence*).

Suggested title: “Future Land-Use Decisions and Options Will Increasingly Focus on Climate Mitigation and Adaptation at the Exclusion of Other Considerations.”

This is an important key message, and it has been framed well by the authors. To distinguish this chapter from others on individual land covers and sectors, it may be useful to bring in the concept of nature-based solutions, or natural climate solutions, which will heavily focus on the land base. The chapter authors could use literature such as from Seddon et al. (2021).

Comments on Text Supporting the Key Messages

The supporting text is written well and cites references well. However, the Committee has two major concerns. First, the chapter provides the land systems framework in the introduction, but the text supporting the key messages reviews individual sectors or land covers (e.g., forest, agriculture, developed land). It would improve the chapter and distinguish it from other chapters if the text adhered to the overall land systems framework or as noted, a land change science perspective (see references above). Laying out the broader framework of LCLUC importance overall, the changes observed in land cover and land-use separately, and the drivers and impacts of LCLUC would improve the usefulness of the chapter. A few cogent examples would then be useful to demonstrate ideas discussed without having to cover all cases of specific LCLUCs.

Second, it is critically important to accurately report numbers and data and use a standard source consistently across all chapters. It is important to adhere to one type of statistical unit (e.g., square miles or acres but not both) and perhaps consider change metrics expressed as absolute values (not percentages) with specificity on whether the change is net or gross.

Key Message 6.1. Land System Goods and Services. The section lays out some important considerations. The land system is important for the provision of goods and services and economic vitality. This key message could provide more background for Key Message 6.3, which is the most important component of this chapter. This key message does well to point out the economic implications of climate destabilization of built infrastructure, and it may be useful to examine the same for other infrastructure aspects such as agriculture—for example, excessively wet spring conditions prevent planting.

The impact on goods and services is noted, but the range of specific examples of impacts across various sectors would be too numerous to delineate them all in this chapter (e.g., agriculture, forests). Thus, the chapter should present a few cases as examples, perhaps using a

box. It would be useful to report on studies that have looked at the economy from a larger perspective; for example, see Kubiszewski et al. (2020) and Weiskopf et al. (2020).

Key Message 6.2. Land System Resilience. This key message demonstrates how climate change will influence the ability of all land systems to mediate impacts, which is useful. This framing is helpful for this chapter because there are other chapters that treat ecosystems, forests, and agriculture individually. It would be useful if there were more cross- references to other chapters. The discussion of economic impacts is useful. There is also a discussion on how multiple interactions between land cover and use are important. However, Figure 6.7 is bulky and defeats its purpose. Perhaps some case studies or examples would be a better substitute.

The emphasis on the importance of development needs reconsideration because although it is a rapidly changing land cover, its overall magnitude is less than some other land cover types. The discussion of interactions in the land system is useful. However, it is reduced to a few examples of ecosystem dynamics. It would be useful to elaborate on climate interactions in the context of a land systems framework, or through the lens of land change science, which would focus on LCLUC-specific issues. This is also a place to discuss nature-based solutions or natural climate solution frameworks, offering insights on the value and characteristics of land-based adaptation and mitigation.

Key Message 6.3. Future Land-Use Options. It is important for the chapter authors to carefully discuss current trends and status of LCLUC; some studies suggest the rate of land conversion is diminishing and will continue to decrease into the future. The current data on land cover in the United States suggests that pasture is the largest category and urban is the lowest, yet the draft NCA5 report emphasizes urban development and barely discusses pasture. This chapter seems to suggest that developed land is the cover category with the greatest net change in area. However, because change can be an increase or a decrease in area, this is misleading because combined area changes in forest, agriculture, and pasture far exceed developed, as well as the net change, according to NCA4 and Auch et al. (2022) since 2016. Therefore, either something has changed recently or the draft NCA5 report is inconsistent with past assessments and recent literature. Moreover, there appears to be evidence that these vegetative cover classes also declined in *use*, which would be an important observation to explore and project into the future. Auch et al. (2022) notes that the percentage of land in CONUS undergoing cover change each year has been declining. The two most prominent patterns of land-cover change were natural resource cycles and increases in urban and built-up land. Natural resource cycles accounted for 80 percent of all annual gross change, with these processes mostly involving the loss and gain of tree cover through harvest, wildfire, other natural events, and its regrowth, as well as fluxes between cropland and grass/shrub. Gurgel et al. (2021) uses a multidimensional econometric model and suggest no major shifts in land-use change trajectories, with most future changes in agriculture, not developed land (urban). The emphasis on developed land conversion diminishes other land-use changes of importance, such as conversion of grasslands to croplands for biofuels (Lark et al., 2022).

Comments on Traceable Accounts

Traceable accounts are done well but lack citations in some places, except for Key Message 6.3. However, due to the lack of projections and forecasts on specific important climate change impacts related to LCLUC, the connection between the literature and the statements in the key messages is weak. The chapter does an adequate job using confidence and likelihood in

its key messages, but the statements are not adequately justified in the traceable accounts. Consideration of literature on land system drivers, such as economic or production factors, and how they are influenced by climate change should be added. Also, traceable accounts could be improved by organizing them by human system and natural system drivers and factors. In the context of this chapter, LCLUCs are largely driven by human decision making rather than natural events, which are better described in other chapters. However, some of these economic or production drivers may be influenced by natural factors and climate change. For example, the authors of this chapter have done an excellent job noting the importance of land-use choices and their constraints due to climate change. Thus, it would improve the traceable accounts if there were a clear distinction between the literature and science that supports the human drivers and the literature and science that supports the climate and natural systems drivers.

Comments on Graphics and Boxes

The graphics should be reconsidered. There are specific mentions of graphics issue above, but generally they do not capture the reader's attention, and some are confusing. Graphics could be better used to support boxes and/or specific examples. A good approach to graphics can be found in Chapter 5 (Land Cover and Land-Use Change) of NCA4.

Figures 6.1 and 6.2 should include Alaska and Hawai'i. The zoom-in boxes in Figure 6.2 are useful to show additional detail which would not be apparent in the national-scale maps. Chapter authors should consider adding additional inset boxes, and add some simple overlays, such as the Yellowstone National Park boundary, to help audiences relate to the content.

Comments on Equity and Justice

There is little discussion of the equity and justice dimensions of LCLUC, which should be improved because equity and justice implications are very important in the context of LCLUC. It might be useful for chapter authors to lay out how Key Messages 6.2 and 6.3 relate to equity and justice, particularly the way choices could be constrained, and ways to think about inclusion in the process of decision making under climate change and LCLUC influences.

The equity and justice framework could be broadly used to consider the distribution of benefits and harms, recognition, and participation. The chapter could consider the equity and justice framework historically; what drives LCLUC decision making by whom? For whom? How? This approach could be used to consider these factors relative to climate change. The authors already note well how climate change will constrain land-use decisions generally, and chapter authors could also explore land-use decision making in the equity and justice context. Multiple histories of social and spatial marginalization with impacts on present-day LCLUC include zoning decisions, investment/disinvestment, redlining and connection to present-day spatial distribution of grey and green infrastructure, and ecological fragmentation.

There are also potential issues related to mitigation and adaptation because land systems are likely to be significant parts of many policies and measures. Chapter authors should consider the distribution of benefits and harms in this context, as well as decision-making structures or frameworks that may increase or reduce vulnerability to climate impacts and land-use impacts.

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible. Finally, specific gaps in

equity- and justice-related literature with respect to the chapter focus should be noted in the text or traceable accounts.

Comments on Data and Analyses

The analysis of data is fine, but there are few quantitative insights on how LCLUC and climate change could impact the economy. It would be useful to include a few examples. As noted above, it is important to make sure that the data on LCLUC are correct, consistent, and standardized, adhering to definitions and concisely stated in common units.

Comments on Literature Cited

The cited literature is good except in three areas: (1) concepts and findings from the land change science literature could be used more, especially as a way to frame the chapter in a broader LCLUC framework, which is a science area of its own; (2) the chapter could reference the current data on land cover and land-use areas and changes, some of which have been provided here; and (3) the drivers of LCLUC are perhaps distinct from drivers of ecosystem changes—they include economic and yield factors, for example. It would be an improvement to use this literature, especially for analyzing projections in Key Message 6.3. Some references could be updated with more recent literature.

Other Recommended Changes

There could be more emphasis on the connection between mitigation and adaptation and the importance of LCLUC. In addition, LCLUC is often referred to as the “other global change” and it will have its own impacts at the same time as climate change. This point is not well treated; the importance of LCLUC and its role as a mediator for climate change could be discussed more. Lastly, the chapter omits complex changes and impacts (e.g., degradation, fragmentation, regeneration in odd locations) in favor of simple changes and impacts (e.g., infrastructure).

CHAPTER 7: FORESTS

Summary

This is a generally strong chapter that reviews the important aspects of climate change impacts on forests in the United States, emphasizing its impact on creating new and complex changes to disturbance regimes, the potential for losing forests’ capacity to continue to provide abundant and important goods and services, and the challenges and prospects ahead for adaptation management of forests. These three elements form the basis for three important, logically framed and presented key messages. The chapter meets the requirements of Section 106 of the GCRA but could be more explicit in the evaluation of projections.

Climate change impacts are presented well in the context of current and potential adaptation responses, but more examination of mitigation could be added. Generally, the chapter captures the most salient new developments in scientific understanding, the evidence base, and

research gaps. However, at times, the text is too nuanced for the intended audiences, defined in Chapter 2 of this report. For example, the discussion of how climate change exacerbates existing disturbances, interactions between disturbance agents, and disturbance regimes could be bolstered with different examples. The writing is at an appropriate technical level but could benefit from more citations emphasizing the domestic forest research basis of the key messages and fewer citations from global-scale forest analyses, as well as adding clarity and specificity on the emissions and removals estimates, since forests are a significant sink.

The key messages are objective and include statements where there is strong and weak evidence or certainty. Key messages also acknowledge complexities in attributing impacts, for example, referencing the compounding influence of management and land-use change. Although there is an explanation given in the traceable accounts, both confidence and likelihood levels should be assigned to statements in the key messages, consistent with definitions presented in the Front Matter and used in other chapters.

The Committee commends the chapter authors for their use of cross-chapter references to other key messages. The treatment of equity and justice, however, is light, giving most attention to Indigenous communities. This discussion could be enhanced with examples of notable successes, for instance, with tribal communities' mitigation and adaptation examples that are well known in the literature and public record and discussed in other chapters. Finally, the importance of natural variability cannot be overstated when trying to evaluate climate change impacts and demonstrating the difference between climate change and natural variability; it would be useful to acknowledge these differences to provide more confidence in the chapter's key messages.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction is adequate but provides mostly background on the importance of forests. The addition of short text on how climate change impacts are affecting forests would provide essential context for the key messages and would balance the introduction with the rest of the chapter. The three key messages are logically ordered, so a few sentences in the introduction would provide readers with a chapter map (i.e., complex and changing disturbance regimes, resulting loss of value in goods and services, and adaptive and mitigative responses are under way but more will be needed) to provide relevant context. Whether here or later in the chapter, it may be useful to address the issue of the recent loss of forest stock and the associated risks of a declining carbon sink at a time when adaptation and mitigation measures need to enhance biological sinks, especially in forests. Additionally, introducing the importance of forests for overburdened communities would also be valuable in the introduction to help better integrate equity and justice principles throughout the chapter. Similarly, the introduction lists the goods and services that forests provide, including “spiritual renewal” but does not mention the Indigenous cultural values of forests. Although these cultural values are covered in Key Message 7.2, they are also important to integrate into the introduction.

Finally, more discussion of the role of natural variability in addition to climate change would benefit the chapter; to frame this discussion, the Committee suggests adding a sentence in

the introduction about how extreme events occur naturally and how climate change can change the frequency.

Comments on Key Messages, Supporting Information, and Traceable Accounts

The three key messages presented in this chapter accurately reflect current understanding of impacts associated with climate change are logically connected and follow a good sequence. However, as presented, their titles are not effective. Each key message is well described by providing the reader with background on how forest ecosystems function and how changes could occur with climate change and the implications for forest structure and function, their provisions of ecosystem services, and management challenges. They are written well and presented objectively, considering areas of certainty and areas of uncertainty. The use of confidence rankings is adequately done, but the use of likelihood differs from the definition used in the report and by other chapters. This chapter is very similar to the chapter on Forests in NCA4—for example, the three key messages are the same and the emphasis on fire (severity and scale), extreme weather effects, carbon, and water are overlapping. This chapter should emphasize more the interaction of disturbance agents, which would be an important new element to present, but it would need additional detail and better examples in Key Message 7.1 (e.g., the example on bark beetles is good but that on ghost forests, which is more of a direct impact issue, is less useful). Continuing to update audiences on the impacts of the provision of goods and services is useful, but new evidence or examples would be more insightful than those presented. To this end, the declining carbon sink observation presented here is also perhaps new in Key Message 7.2, so that could be elaborated on.

The key messages, especially Key Message 7.1, focus on the interaction between agents of change. This focus is useful for demonstrating the complexity of system-wide impacts, but the Committee suggests that the chapter authors revise the text to be explicit about the interactions between agents. For example, to increase readability, it would be useful to better describe interactions of climate factors, such as temperature and drought, and interactions of ecosystem factors, such as pests and fire and include brief text that makes it clear how scientific evidence is distinguishing between the natural background variability and attribution to climate change.

Most of the text on risks and impacts is somewhat general. It would be useful to have a few specific quantitative forecasts of impacts or provide an update on the discussion of “future forests” from NCA4. The key messages focus on impacts from climate changes related to extreme events and impacts related to increased severity and frequency due to precipitation and temperature.

Lastly, the discussion of equity and justice should be bolstered. There is some discussion of Indigenous communities, but less on other aspects of diversity, including key issues such as access to forests benefits generally, and trees in urban areas. There are some good examples of mitigation and adaptation activities in tribal areas that could be discussed in detail, such as the Yurok tribal forest carbon credit projects in northern California, which are long-standing climate change mitigation and sustainable forest management examples that demonstrate the effectiveness of alternative models of natural resource management (Fleischman et al., 2021; Manning and Reed, 2019).

Comments on Specific Key Message Language

Key Message 7.1. Climate Change Affects Forest Change

Forest ecosystems support livelihoods, regulate climate, and maintain and protect biodiversity. Climate change is increasing the frequency, scale, and severity of some disturbances that drive forest change (*high confidence*). Continued warming and regional changes in precipitation are expected to amplify interactions among disturbance agents (*likely, high confidence*) and further alter forest ecosystem structure and function (*likely, high confidence*).

Suggested title: “Climate Change Is Now a Dominant Form of Human-Induced Disturbance to Forests That Exacerbates Existing Disturbances.”

This key message is well done, but there is some confusion in the title and the key message text with the use of “change” twice. The Committee suggests an alternative, formulated as a statement as shown above. This key message first introduces a few important disturbances affected by climate change, including increased fire severity, pests and insects, and disease. It then introduces factors that affect forest indirectly due to changes in climate factors such as drought, extreme weather, and others that exacerbate the disturbance impacts. For example, drought or warmer winters affect pests which causes increased disturbances. Thus, while this key message is very similar to the presentation in NCA4, it introduces or emphasizes new concerns about complexities introduced by disturbance interactions. As this point is important, the Committee suggests elevating it within the key message. Additionally, it could be strengthened by elaboration, more focused examples, and noting the importance of distinction from natural variability in the supporting text.

Including a point about direct and indirect influence of climate change means the text should clarify whether the supporting evidence points directly to climate change or to factors that are logically but perhaps not demonstrably linked to climate change. For instance, the sentence “Climate change is increasing the frequency, scale, and severity of some disturbances that drive forest change (*high confidence*)” is fine. However, it is unclear whether evidence exists, and confidence is high, that climate change has in fact, caused severity to increase and has resulted in some impact on forests. It is important to be concise and perhaps explain the evidence directly in the text supporting the key message or in the traceable accounts. Also, the use of the words “some disturbances” is vague, and the Committee suggests rephrasing or elaborating with examples.

Key Message 7.2. Climate Change Affects the Goods and Services Provided by Forests

Forests provide goods and services that enrich human lives and sustain life more broadly. Increasing temperatures, changing precipitation patterns, and altered disturbances are reducing the capacity of forest ecosystems to sequester and store carbon (*high confidence*), provide clean water and clean air (*high confidence*), produce timber and non-timber products (*high confidence*), and provide recreation (*medium confidence*), among other benefits. Future climate effects will interact with societal changes to determine the future capacity of forests to provide goods and services (*likely, high confidence*).

Suggested title: “Climate Change Alters and Diminishes the Goods and Services Provided by Forests.”

Unlike Key Message 7.1, this title is already an informative statement, but a slightly modified example has been provided.

Key Message 7.3. Adaptation Solutions

Climate change creates challenges for natural resource managers charged with preserving the function, health, and productivity of forest ecosystems (*high confidence*). Forest landowners and managers are preparing for climate change through the development of vulnerability assessments and adaptation plans (*high confidence*). Proactive adaptation of management strategies that create, maintain, and restore resilient forest ecosystems are critical to ensure continued and equitable provisioning of goods and services (*high confidence*).

Suggested title: “Forests Provide Significant Adaptation and Mitigation Opportunities, But Some Forests Are at Risk.”

Comments on Text Supporting the Key Messages

The supporting text for the key messages is strong but sometimes rather nuanced. Some of the ideas repeat NCA4, so emphasis should be placed on the new material and evidence, such as the interaction of disturbances and the shrinking carbon sink. However, when using estimates of emissions and removals, some standardization of data sources should be used, and where differences are necessary (e.g., in Key Message 7.2), they should be clearly described in the text supporting the key message or traceable accounts. The key messages would all benefit from more cogent examples. Similarly, the chapter is strong on presenting evidence of trends, but this should be followed by a brief statement about how a trend is directly attributed to climate change. Forecasts would be useful, as would some references to economic impacts in Key Message 7.2. The chapter overall is good at identifying cases where evidence is weak, but it should also clearly state what is known. Key Message 7.3 is good but heavily focused on adaptation and should also include a discussion of mitigation. To do that well, it would be important here and in other chapters to ensure that there is consistency in how emissions and removals are reported, and in the data source(s) used. In particular, the forest sink term is reported differently throughout the draft NCA5 report, not only in the magnitude but also in attribution (e.g., agricultural land abandonment is noted as a major sink in Chapter 11 (Agriculture, Food Systems, and Rural Communities) when it is not actually reported as such in EPA [2022]). In the draft NCA5 report, the emissions from harvested wood products (HWP) are reported with no reference nor explanation of how or why it appears to differ from EPA (2022) and Domke et al. (2021).

Key Message 7.1. Climate Change Affects Forest Change. In addition to the points mentioned above, it is noted that climate change would amplify the interactions of agents of disturbance but assumes the reader will know this is a negative influence. Forests are dynamic; they experience disturbances, but climate change will increase the frequency and severity of these agents. There will be interactions among them (e.g., drought, insects or pathogens, tree die off, hurricanes, land-use change, fire). The chapter points out that fire suppression and land-use change reduce the adaptive capacity of forests to climate change. The text discusses tree

mortality as an impact, but there are also more complicated and serious impacts on overall demography, especially the balance between mortality and recruitment, which itself is complicated by fecundity and migration dynamics.

Key Message 7.2. Climate Change Affects the Goods and Services Provided by Forests. This key message extends logically from Key Message 7.1 and aims to identify the important ways climate change reduces the current and future provisioning capacity of forests. Emphasis is given to carbon sequestration, non-timber products, biodiversity, heritage and cultural values, recreation, and water. These are important and could be strengthened by emphasizing economic impacts or cross-referencing other chapters. Estimates for future economic impact, including from HWPs, would engage readers. The key message is very similar to what was presented in NCA4. A new emphasis could be a focus on reductions in the current forest sink, which is important. Although this is in part attributed to land-use change, it would be useful to explicitly emphasize the link to climate change and supporting evidence.

As in other chapters, current estimates of emissions and removals of carbon and other GHGs is provided as an important consideration. However, the text supporting this key message is confusing regarding the source of data and how they are used. As discussed in Chapter 2 of this report, the Committee suggests using a standard source for the US GHG inventory (i.e., EPA, 2022). In doing so, this chapter should explain how the US Department of Agriculture (USDA) estimates may differ (i.e., how harvested wood products are computed as emissions and removals). The citation to Domke et al. (2022) does not exist in the references, and it is not possible to locate the citation nor a publication that can be used for Figure 7.8. The net sink term from this chapter and in this figure appear to contradict other estimates in other chapters. These estimates also appear to contradict EPA (2022), and the estimation method in this chapter appears to differ from EPA (2022); here, the net sink is diminished compared to EPA (2022) due to high emissions from HWPs that are not clearly reported in national inventory reports. The reader should be aware that a HWP pool has emissions and is only effective over the long term if the harvested wood is part of a rotation with regrowth. The citation to Johnston and Radeloff (2019) is not the best citation or should be clarified because it is a global analysis and does not consider the rotation issue in the same way as in the US inventory.

This key message does a good job of distinguishing between chronic and abrupt changes. Additionally, this key message is an adequate discussion of environmental justice and cultural issues, but it is somewhat narrow. The discussion could include success stories from Indigenous actions and management such as carbon management on tribal land (e.g., Yurok). There are no citations for the first sentence of each of the first three paragraphs of the supporting text for this key message (page 7-10, lines 17-27, and page 7-11, lines 1-7), making these sentences appear as assertions. The text would be more compelling with citations, and the Committee suggests rewriting assertions to avoid stand-alone text without citations.

Key Message 7.3. Adaptation Solutions. This key message is well done and backed by evidence and examples. It could be improved using better examples from an equity and justice perspective. As mentioned above, there are good examples from tribal management of carbon projects for both mitigation and adaptation. The focus is on adaptation solutions, but mitigation is also very important for forests. One of the most important messages relates to the already strong role forests play as carbon sinks, and this is currently at risk due to a decline in forest stock and productivity caused by climate change (e.g., fire) and land-use change (e.g., urban encroachment). This point and the loss of buffer against severe impacts of fire at the wildland-urban interface could be stated more strongly.

Comments on Traceable Accounts

The trend and current emissions and removals of GHGs have not been considered coherently in this chapter; placing more emphasis on mitigation versus adaptation could help. However, the estimates of carbon and CO₂-equivalent in this chapter are difficult to interpret; they appear to have inconsistencies with other chapters and within this chapter. This chapter suggests that the national net sink for carbon is ~402 Mt CO₂-equivalent in 2020. This is based on Net Ecosystem Carbon Balance in 2020, taking into consideration transfers and emissions from HWP. These estimates appear to differ from other chapters, from the incorrectly cited Domke et al. (2022) (which is perhaps Domke et al. [2021]) and EPA (2022). The traceable accounts section should either reconcile these apparent differences or clearly explain how the accounting is done.

Key Message 7.1. Climate Change Affects Forest Change. The evidence basis for forest disturbances attributed to climate change either directly or indirectly is lacking. These include changes in fire regimes (frequency, magnitude, severity), pests (e.g., bark beetles), forest health, and disease. The traceable accounts provide background evidence for climate change effects on fire regimes, and far less for other factors. Evidence directly showing the linkages from climate change to ecological factors to forest impacts is less clear and should be strengthened. The interpretation of the literature on page 7-8, lines 11-12 is incorrect: “western tree species are migrating poleward through seedling success (Sharma et al. 2021).” The analysis by Sharma et al. (2021) actually cautions that although a migration potential exists due to changing climate factors that influence seedling success, local terrain conditions actually constrain migration at the same time.” Specifically, the paper says: “Whereas fecundity may be primed to lead tree migration in the West, local climate complexity that comes with rugged relief affects how migration potential should be interpreted. The combination of dry climates and fast climate change in the intermountain West explains fecundity and recruitment vectors in Figure 3 E and F that point toward the cool, moist regional climates of the Northwest. However, for migration, these cool-moist conditions are locally found at higher elevations. The regional centroids average over this variation contributed by steep terrain.”

Additionally, natural variability is important, not only because natural ecosystems such as forests are dynamic and some of the adverse impacts of climate change are also naturally occurring, but also because in any observational sense the climate impact is buried in the “noise” of the natural dynamics and needs to be teased apart from it. This complexity makes it complicated to measure, assess, and attribute impacts to natural variability versus climate change. This complexity could be noted, with a rationale or examination of the evidence within an explanation of how the science can attribute climate change impacts. Clarifying these attributions is especially important for Key Message 7.1 since it focuses on the complexities added by multiple agents and stressors.

The discussion of gaps is very useful, but it may understate the current knowledge gaps. One reference worth citing and describing is the recent report by Novick et al. (2022), and overall, the discussion of gaps could be expanded with more citations. One area of concern not addressed in this section is the multiple, and perhaps confounding, influence on climate change from forest management and forest cover change. This is a consideration of the difference between radiative forcing due to GHGs and surface water and energy balance; in some cases, forest cover increases warming even while it sequesters carbon. The traceable account rightly acknowledges gaps in understanding related to hydrology.

Key Message 7.2. Climate Change Affects the Goods and Services Provided by Forests. This key message focuses on the importance of changes in US carbon sinks, forest products, ecological functions, cultural and heritage values, recreation, and water resources. As noted above, there should be a discussion on the data sources and use of data on emissions and removals. The new estimates on forests that appear in Figure 7.8 are neither referenced nor cited. Domke et al. (2022) is cited in the traceable accounts but not found as a reference; if this is a mistaken reference to Domke et al. (2021), then the citation in the traceable accounts is misplaced. Other than carbon sequestration and water, the main statements in the key message are associated with diminished goods and services, including changes in the range and abundance of species, heritage values, recreation, and health, but only supported by a few references to literature. This section of the traceable accounts could be bolstered.

Key Message 7.3. Adaptation Solutions. This key message focuses on adaptation. The review of evidence in the traceable account is not deep; it would be useful to know more about the review of evidence on the potential for success with assisted migration. The key message does not address mitigation, so there is no discussion of it in the traceable account.

Comments on Graphics and Boxes

There are many graphics and figures that were not available for the Committee to review, so evaluation here is limited. Key Message 7.1 would be improved if the figures and boxes directly expanded on the idea of interactions with and between agents of disturbance to highlight this aspect and advancements since NCA4. Table 1 from Key Message 7.3 has errors. Figure 7.7c attributes the decline in the US carbon sink to tree mortality but in other places and chapters, the reason is given as land-use change. The Committee has additional comments on individual graphics and boxes below.

Figure 7.1 is useful but needs an expanded caption and a citation. Additionally, it is not clear what the pink, white or grey colors are, and clarification would be useful.

Figure 7.3 is not shown but could be eliminated or replaced. It is indeed a good example of direct forest impact from climate change (SLR) but detracts attention from the point about the interaction of disturbances.

Figure 7.4 is not shown. It may be useful but possibly more relevant to NCA4 than here.

Figure 7.5 is somewhat general and might be replaced.

Figure 7.6 is not clear where it shows spruce beetle damage, and the box may serve the reader better.

Figure 7.8 should be better documented and explained. Abbreviations should be defined. It is unclear where these estimates are sourced, and how they are derived, compared to other sources such as EPA (2022).

Figure 7.10 is not useful on its own and does not show examples of adaptation practiced as referenced in the text.

Box 7.2 would be very useful if more details are included, and the numbers are verified.

There is an opportunity to create a box in Key Message 7.3 describing the Yurok tribal work in carbon management, sustainable forestry, and heritage values.

Table 7.1 is useful and would be improved with a box for Key Message 7.3.

Comments on Equity and Justice

Broadly, there should be more integration of equity and justice, including in the introduction. There are opportunities for positive stories of successful adaptation and mitigation, especially from tribal communities. There is adequate discussion of Indigenous communities, including traditions and governance issues, but this discussion could be bolstered with the inclusion of adaptation and mitigation examples of carbon management projects, such as the Yurok projects in California and the Great Lakes states. Additionally, different dimensions of equity (distribution of costs and benefits, recognition, procedural, intergenerational equity) as they relate to forests should be integrated where possible. Discussion of governance and access as well as supporting literature should be included. Urban heat islands and reforestation efforts, particularly in formerly redlined areas, can be discussed.

There is an emerging literature on urban forestry and environmental justice (Grant et al., 2022; Watkins and Gerrish, 2018), which could be referenced to review ways to remedy past inequities and create future benefits derived from new approaches to the management of urban tree systems (Nyelele and Kroll, 2020; Zhou et al., 2021).

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible, to highlight the interconnectedness and complexity of these issues. Finally, specific gaps in equity- and justice-related literature with respect to the chapter focus should be noted in the text or traceable accounts.

Comments on Data and Analyses

Data analysis is generally well done, but there is little analysis for future projections, nor specific forecasts in terms of economic loss or cost of lost ecosystem services. The analysis of hardwood products and the US carbon sink should be clearly stated and described.

Comments on Literature Cited

Generally, the chapter cites appropriate literature, but the use of global literature can confuse the reader since the condition of US forests is vastly different than the global condition and trends (Auch et al., 2022; Kubiszewski et al., 2020). There are also more sources available on research gaps (e.g., Novick et al., 2022; Seddon et al., 2021) that would strengthen the chapter. In addition to citations provided to examples from Yurok, more references to Indigenous forest management and restoration could be explored, such as Reyes-García et al. (2019) and Long et al. (2020). The citation made in this chapter to Domke et al. (2022) is confusing—the Committee cannot find it referenced and does not readily appear in the literature when searched. If it is an update of Domke (2021), which is also cited in the chapter, it is an important reference given how it is used for evidence. Another issue with the literature cited is the lack of standard references for some important data, discussed above. For example, the chapter should use a standard GHG emissions reference or source, such as EPA (2022). This could be augmented with any critical USDA data on GHG emissions, when differences are explicitly stated and reconciled. Similarly, there should be a standard and common reference or source for land-use change data and statistics.

Other Recommended Changes

It may be worth explaining briefly in the introduction why forested ecosystems have their own chapter (in addition to Chapter 8 [Ecosystems, Ecosystem Services, and Biodiversity] that covers all types of ecosystems). Is it their extent, the economic value of goods (provisioning), their importance for regulating services, carbon sequestration? These are all implied in the introductory material but should be explicitly stated. No other terrestrial ecosystem (e.g., rangelands) is the sole focus of a single chapter.

CHAPTER 8: ECOSYSTEMS, ECOSYSTEM SERVICES, AND BIODIVERSITY**Summary**

Chapter 8 (Ecosystems, Ecosystem Services, and Biodiversity) analyzes the effects of climate change along with other stressors (i.e., other global change drivers) on the natural environment and biological diversity by integrating current evidence about ongoing trends and projected trends for the future. It also examines trends in the knock-on effects of ecosystem change on agriculture, water resources, and human health and well-being (“ecosystem services”). The key messages encompass the key impacts of global change on ecosystems and reflect the current understanding that climate change interacts with other global change drivers to affect ecosystems. Emerging issues identified included abrupt changes triggered by extreme (weather) events. Also novel, the chapter provided a framework for adaptive ecosystem management—Resist-Adapt-Direct. Examples of operational adaptation (e.g., restoration, habitat protection, assisted migration, intensive management) were included. This chapter examines natural ecosystems and does not go into detail on managed ecosystems such as agroecosystems or working forests. It would be useful to provide this perspective to the reader as well as references to other chapters that discuss these issues. The chapter could explicitly note that it does address land-use and other human impacts, which provides useful and important context.

Key findings are generally stated at an appropriate technical level (see specific suggestions for plainer language and avoiding jargon) and are supported by evidence that is documented in a credible way (see specific suggestions for providing concrete examples). The chapter includes many abstract or general mentions of adaptation, and more specific examples would enhance the narrative. While the chapter broadly meets the requirements of Section 106 of the GCRA, it would also be more compelling if the introduction began with a stronger message reminding the reader that ecosystems are central to everything humans (and all life forms) do, make, breathe, and eat—reliance that is invisible or abstract to many people in their day-to-day lives.

Chapter 1 (Overview) in the draft NCA5 report emphasizes many issues in Chapter 8 (Ecosystems, Ecosystem Services, and Biodiversity) (e.g., climate change harms ecosystems and reduces ecosystem services; coral reefs and rainforests are particularly vulnerable to extinctions; without emissions reduction ecosystem change may be irreversible; adaptation options are limited but restoration could be targeted). However, Chapter 1 (Overview) could emphasize more that climate change interacts with other stressors that affect ecosystems (e.g., human activities including land-use, pollution, overharvesting, and novel pests and pathogens), as is emphasized in this chapter. Chapter 1 (Overview) uses the term “compound” in several

instances; there could be more consistency between this chapter and Chapter 1 (Overview) on the concept and terminology for multiple stressors, and compound events or effects.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction explains that humans depend on ecosystems and biodiversity (ecosystem services), and outlines, with examples, how climate change damages and changes ecosystems and how those impacts degrade ecosystem services. The introduction also outlines risks to ecosystems and lists adaptation strategies. However, the chapter needs a stronger lead conveying with urgency that ecosystems are central to the fundamentals of living. The introduction should emphasize how human actions are threatening the Earth system including the biosphere; the extinction event we are causing will be visible in the fossil record for as long as Earth persists. Context should be provided to explain how species make up ecosystems that provide air, water, food, materials, and energy. Through kinship and reciprocity, ecosystems also are the foundation of human spiritual and mental health. These “fundamentals” about ecosystems as life support, are given in the first few paragraphs but could be strengthened through rewording.

This framing could include an even more basic reminder of important first principles—key concepts such as “ecosystems,” “biodiversity,” and “adaptation strategies” (as they apply to ecosystems) should be briefly defined without jargon in the introduction. For example, the reader should be reminded that ecosystems consist of plants and animals, and plants not only provide food at the base of food webs, but they also fix carbon and release oxygen (making life on Earth possible for air-breathing animals). The introduction should mention that the biosphere is important to the global carbon, nitrogen, and other biogeochemical cycles and how the biosphere is already buffering against climate change through sinks and feedbacks. This basic description of what ecosystems are and do is implied in the chapter where, for example, carbon sequestration in ecosystems is mentioned in several places. It would, however, improve the impact of the chapter to briefly introduce the chapter’s “main character” (ecosystems) in this way. Some text could be moved up to the introduction from later in the chapter (e.g., page 8-7, lines 16-18) so that the word count would not increase with these additions. In addition to the key concepts already mentioned, “ecosystem services” should be defined in the introduction before it appears elsewhere in the chapter (e.g., in Figure 8.1).

Comments on Key Messages, Supporting Information, and Traceable Accounts

Overall, the key messages encompass the key impacts of climate change on ecosystems and reflect current understanding that climate change interacts with other global change drivers in affecting ecosystems. The key message titles should be written as short, informative statements, rather than few-word headings.

Comments on Specific Key Message Language

Key Message 8.1. Ecosystem Transformation

Climate change, together with other stressors, is driving transformational changes in ecosystems (*very likely, high confidence*), which presents increasingly serious challenges for natural resource management (*very likely, high confidence*). Many types of extreme events are expected to increase in frequency and severity and potentially trigger abrupt ecosystem changes (*medium confidence*). Adaptive management to prepare for, respond to, and lessen potential impacts can be advanced by decision frameworks that identify key risks and by monitoring for early warning indicators (*medium confidence*).

Suggested title: “Ecosystems Are Being Degraded and Irreversibly Altered by Climate Change.”

This key message appropriately emphasizes the interaction of climate change and other stressors, as well as current understanding of abrupt and irreversible change. The key message manages to avoid jargon (e.g., the key message uses the term “tipping point” but also defines what it means). While the key message is somewhat abstract, examples are given in the subsequent text. However, “transformation” is not consistent with terminology in the current literature: degradation and collapse (Keith et al., 2015, 2022).

Additionally, the key message could have been written in even plainer language. Here is an example of paraphrasing (we have not included the certainty language in this example for simplicity):

Climate change along with other human-caused stressors like habitat loss and pollution, is completely transforming (degrading) some ecosystems (transformations that may not be reversible—ecosystem collapse) and increasing extreme weather events like hurricanes and marine heat waves are likely to trigger abrupt change. Examples of ecosystems on or over the brink of collapse are coral reefs and Arctic tundra. Ecosystems should therefore be monitored to look for signs of change and managed adaptively with an eye toward the future.

Key Message 8.2. Species Changes and Biodiversity Loss

The interaction of climate change with other stressors is causing biodiversity loss, changes in species distribution and phenology, and increasing impacts from invasives and diseases, all of which have economic and social consequences (*very likely, high confidence*). Future responses of species and populations will depend on the magnitude and timing of changes, coupled with differential sensitivity of organisms, with heightened extinction risks for some (*very likely, high confidence*). Identification of risks and prioritization of species and locations for protection will improve options for management (*very likely, medium confidence*).

Suggested title: “Climate Change Displaces Species and Reduces Biodiversity.”

The key message identifies the links between ecosystems (made up of species and their environment) and things people care about (security, livelihoods, and treasured aspects of nature). The key message could be paraphrased with plainer language (we have not included the certainty language in this example):

Climate change together with other stressors such as land-use and pollution are affecting populations of organisms, sometimes with compounding effects, leading to changes in phenology (e.g., seasonal timing of flowering), changing distributions and species loss, and increasing impacts of pests and diseases; these changes have economic and social impacts. It is important to identify risks and prioritize species and areas that are at the greatest risk for protection, management, and restoration (coral reefs, and insect pollinators are examples).

Comments on Text Supporting the Key Messages

Key Message 8.1. Ecosystem Transformation. In the text supporting this key message there are opportunities to add some specifics to the examples given. For example, the text could explain how extensive some of these “abrupt and irreversible changes” are in the tundra, coral reefs, and sagebrush rangelands shown in Figure 8.6, and explain the implications (e.g., loss of critical habitat for endangered species along with rangeland livestock production, magnitude of carbon that could be released from permafrost, numbers of unique species lost from US tropical forests as a proportion of all US species). There are many good examples given on invasive species risk (page 8-22), but the example of woody encroachment in grasslands is also a widespread large-scale ecosystem transformation in drylands that should be noted somewhere. Furthermore, it could be noted if in some cases, species invasions are driven directly by increased atmospheric CO₂ concentration, rather than the climate changes caused by GHG emissions.

Key Message 8.2. Species Change and Biodiversity Loss. In the text supporting this key message, abundant evidence for current trends and future risks is given, emphasizing crop pollination, disease threats to humans and wildlife, and invasive species. Examples are also given of adaptive management. More emphasis could be placed on diseases and pests affecting plants—bark beetles are mentioned, but little else—although this could also be placed in Chapter 7 (Forests) or some regional chapters where forests are important, and those chapters could be cross-referenced in Chapter 8 (Ecosystems, Ecosystem Services, and Biodiversity).

It is worth emphasizing even more pointedly that the greatest human driver of terrestrial biodiversity loss is, and has been, habitat loss due to land-use. Climate change and other stressors layer on top of land-use changes with the compounding effects mentioned in the chapter. Species cannot easily “shift their locations” as the climate shifts if intervening places are modified and, therefore, inhospitable to movement, and this should be noted in the text.

Key Message 8.3. Ecosystem Services Risks and Opportunities. In the text supporting this key message, it would be useful to clarify, when nature-based solutions (NBSs) are discussed (page 8-27), that those “solutions” mainly consist of ecological restoration or habitat and species conservation (as is clear in Figure 8.19), which is why there are virtually always “biodiversity” co-benefits. This would better tie the new, but now widely used, concepts of NBSs (focusing on biodiversity) and natural climate solutions (NCSs, focused on climate impacts) to more traditional concepts in ecosystem management.

Moreover, this key message focuses on NBSs, but leaves agriculture out of NBSs for climate mitigation (Figure 8.19), whereas IPCC would include agroecosystems in NBSs for carbon sequestration. The concept NBSs comes from the biological conservation literature and is related more broadly to sustainability, while the NCS concept comes out of the climate community. In fact, Figure 8.19 is adapted from a paper that has “natural climate solutions” in

the title. It is acceptable if the authors want to delimit this chapter to natural ecosystems and not agroecosystems, but on the other hand, “cover cropping” is mentioned as a NBS in Figure 8.18. The chapter should in any case cite other chapters (e.g., Chapter 11 [Agriculture, Food Systems, and Rural Communities], Chapter 6 [Land Cover and Land-Use Change]) that discuss agroecosystem management for climate change (and more broadly global change) mitigation.

Comments on Traceable Accounts

The chapter authors describe the process of developing this chapter with its emphasis on new literature since NCA4. In addition to a diverse group of authors, there were ten technical contributors to this chapter. The traceable accounts section effectively describes the evidence base and uncertainties for each key message.

The traceable account for Key Message 8.1 should include the need for adaptive ecological management to consider power and social equity issues specifically to lead to equitable solutions (page 8-31, line 34).

In the traceable account for Key Message 8.2, the ability of climate refugia to reduce extinction risk should be mentioned as an uncertainty given that those areas, too, are at risk under some scenarios (page 8-33, line 2). The traceable accounts section for Key Message 8.2 also includes the potential for human assistance to species migration as an area for future research. In fact, there has been research published on the potential of assisted migration to protect biodiversity under climate change scenarios (e.g., Bonebrake et al., 2014; Etterson et al., 2020). Perhaps the statement on the research gap should be revised to narrowly focused on the unanswered research question.

Comments on Graphics

In general, attention is needed to the figures and tables in this chapter to effectively communicate their messages.

The map in Figure 8.2 is nice way to include all geographic domains included in the draft NCA5 report, but there should be lines around the different geographic parts to show that they are all different maps/scales. The symbols are a good way to communicate change in each region, but they are too small and there is also no key for the icons. The Committee appreciates the inclusion of the USAPI in the map. In the table part of this figure, it would be useful to include a reference for each example and the caption should describe how the examples for each region were selected. In the fourth column for the Midwest, it is not clear that the ecosystem service change is for “loss of lake ice.” Similarly, for “pollen,” the ecosystem service change should be stated explicitly.

In Figure 8.3, some entries in the table portion of this figure are confusing. For example, “plants” in row 2 should be “crops.” Moreover, not all the ecosystem services in column 3 are clear—specifically, it is not clear how the phenomenon listed relates to an ecosystem (dis)service (e.g., “pollen,” “loss of lake ice”). Furthermore, this figure shows global, rather than United States risks (the source is from the IPCC). The caption should explain that it is based on global data.

Figure 8.4 is a useful figure on climate change effects on watersheds, but it is referenced in the chapter to illustrate the idea of occasional extreme events amplifying the negative effects of gradual change, with no mention of watersheds. The figure title and caption should be

modified to make this link clear. The figure also needs to be modified with some horizontal arrows if it is meant to illustrate amplifying negative effects.

Figure 8.6 is a better illustration than Figure 8.4 of occasional extreme events amplifying negative effects of gradual change (i.e., hotter, longer growing seasons, invasive grasses) combined with extreme events (i.e., novel wildfire promoted by invasive grasses in an ecosystem that is not fire adapted) leading to large-scale ecosystem degradation or collapse and loss of ecosystem services. Perhaps Figure 8.4 is unnecessary.

Figure 8.8 is a nice way to show all geographic domains in the NCA5, and it would be helpful if a similar map format was used throughout the report. Lines for Canada and Mexico are attached to the lower-48 states, but not Alaska.

Figure 8.11 should add lines around Alaska and Hawai‘i to show they are different maps, scales, and locations.

Figure 8.13 is a nice summary of a lot of information, although the caption could state more directly what is shown in the figure: it is not just a (random) “varied” response across species, but that in this case managed, wide-ranging non-native species are expanding while native species with narrowed ranges are declining.

In Figure 8.18, instead of “cover cropping,” the phrase “cover cropping and other soil conservation measures” should be used to encompass practices beyond cover cropping.

It is useful to have an illustration in Figure 8.19 showing the climate mitigation potential of NBSs. It is unfortunate that the co-benefits appear as lines and therefore relatively “small” compared to the quantitative carbon estimates shown as bars on the right, but there may be no better way to convey this information.

Table 8.2 is somewhat unsatisfying because while it does give examples of ecosystem services and their indicators, more details in the column on trends would be informative (i.e., time frame and region[s] where a trend had been observed or projected).

Comments on Equity and Justice

The chapter addressed equity and justice issues in the context of unequal access to nature and ecosystem services and is a focus of Key Message 8.3. Pages 8-25 and 8-26 are explicit about communities of color having less access to ecosystem services, and that housing segregation has created inequitable distributions of ecosystem services, specifically, access to urban green spaces that meliorate air quality and heat. These specific and explicit examples of who is harmed, why, and what ecosystem services they lose are very useful.

In contrast, on page 8-27, lines 10-12, the reference to environmental justice “problems” is vague and could be improved by being more specific.

Examples could be added of traditional (Indigenous) ecosystem management and restoration practices that support both cultural and spiritual relationships with nature and an equitable climate transition, for example, by cross-referencing other chapters and citing additional literature (e.g., Chapter 7 [Forests], Chapter 16 [Tribes and Indigenous Peoples]; Long et al., 2020; Reyes-García et al., 2019).

Additionally, equity and justice concerns in natural resource management and conservation are increasingly recognized in mainstream natural resource management policy and practice. Concerns and issues should be identified, especially around equitable benefit sharing. This chapter should also mention the Reducing Emissions from Deforestation and Forest Degradation framework and protected areas for biodiversity conservation.

Comments on Literature Cited

The references are generally appropriate and represent the best recent literature on global change and ecosystems. The authors might consider citing Law et al. (2021) and/or Law et al. (2022) for Key Message 8.3.

Other Recommended Changes

It is noted (page 8-34, lines 29-30, under Key Message 8.3) that CO₂ fertilization affects ecosystem productivity and carbon cycling (and ecosystem services that result from those processes), but generally the chapter focuses on climate change effects on temperature, water balance, etc. The direct effects of increased CO₂ concentrations could be called out specifically and distinguished from increasing temperature effects given their important role as a driver of ocean acidification and resulting profound changes in marine ecosystems. This could be spelled out briefly in the introduction, perhaps with citation to other chapters that may talk more about CO₂ fertilization (e.g., Chapters 3 [Earth System Processes], 10 [Oceans and Marine Resources]).

In the section “Disease Risks” under Key Message 8.2 (page 8-20), in the context of increasing risk of human and wildlife disease, it may be relevant to mention the One Health framework, mentioned in other chapters (e.g., Chapter 23 [US Caribbean]). It may be more familiar to human health experts than ecosystem scientists which may be why it is not mentioned here. This is a question for the chapter authors to consider, not necessarily a recommendation.

In the “Implications for Management” subsection (page 8-23), given the importance of this section, it would be nice to have a table or map showing more examples (by region) of climate change adaptation actions on behalf of species beyond the two mentioned in the text. This is not essential but would be informative, and perhaps there would be room for it if Table 8.1 were condensed or reformatted to be smaller.

CHAPTER 9: COASTAL EFFECTS

Summary

Chapter 9 (Coastal Effects) is written at an appropriate technical level, provides a useful summary of coastal adaptation strategies, and effectively highlights issues of equity and justice—including the disproportionate impact of coastal change on under-resourced communities. However, the chapter fails to meet the third requirement of Section 106 of the GCRA, which states that the assessment should analyze and project major trends. Specifically, this chapter does not address regional sea-level trends and associated impacts across the United States, nor does it provide relevant attribution information and citations highlighting the relative roles of natural variability versus climate change in observed and projected trends. The lack of regional information is problematic because the target audiences of NCA5 is broadly defined as “decision makers,” and it should be made clear that decision makers should not base decisions on continental US averages. There is also a lack of emphasis on low-likelihood, high-impact outcomes related to deep uncertainty and the evolving scientific understanding of instabilities and tipping points in ice-mass loss from West Antarctica, which should be considered by

decision makers with proper context. Finally, the chapter bases many of its conclusions (especially for Key Message 9.1) on the Interagency Task Force (ITF) SLR scenarios, which is not problematic in itself, but issues arise due to differences between the ITF framework used for sea-level and the IPCC framework used for all other climate indicators across the draft NCA5 report. As a result, the application of the draft NCA5 report likelihood language regarding is inconsistently applied, and more effort is needed to make the discussion of sea-level projections in this chapter consistent with the treatment of other climate indicators discussed elsewhere.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The chapter introduction offers reasonable context, but the first paragraph should end with a statement communicating that coastal trends and impacts are highly localized and that interpretation of observed and projected trends should include consideration of regional and local differences.

Comments on Key Messages, Supporting Information, and Traceable Accounts

The key messages reflect basic understanding of nationwide trends and impacts but lack relevant regional and local information, as well as nuanced discussion of the relative roles of natural variability and climate change in observations and projections. The key messages also lack sufficient support for likelihood statements in some cases. The discussion below expands on gaps that span multiple key messages, followed by comments specific to existing content in individual key messages. Additionally, the titles of the key messages should be rephrased to be short, informative statements, consistent with guidance in Chapter 2 of this report.

Regional Differences and Natural Variability

The lack of information regarding regional variations in coastal trends and impacts, and the lack of context in attribution of regional differences to natural variability and climate change is a critical gap in Chapter 9 (Coastal Effects) that should be communicated to decision makers (i.e., the target audiences as defined in Chapter 2 of this report). Presently, the chapter mentions regional differences in trends only once in a general statement on page 9-4, line 3, which is not sufficient, because acknowledging and utilizing regional and local information is essential for accurate science-based decision making and cost-effective adaptation measures. A key directive given to NCA5 authors is that the assessment should be relevant for decision makers, but, as this chapter is currently written, the lack of regional and local information (or even acknowledgment of its importance and where to find it) severely limits the utility of the chapter in the applied realm.

An example of this gap is the lack of any mention that the rate of SLR along the US west coast has been suppressed over the past 30 years by natural fluctuations in the Pacific climate, which is clearly demonstrated by Figure 2.5 in Chapter 2 (Climate Trends) yet not referenced at all by Chapter 9 (Coastal Effects). The spatial variability in sea-level trends is a critical context for practitioners in west coast coastal communities, who may wonder (or need to communicate)

why their coastlines have not experienced the sorts of regular impacts discussed as nationwide trends in Chapter 9 (Coastal Effects). It is equally essential to communicate that the suppression of SLR along the US west coast is associated with the natural climate variability that is expected to produce the opposite effect during future periods leading to enhanced rates of SLR and associated impacts relative to the global and US averages. There is a significant body of literature that discusses the suppression of SLR along the US west coast due to Pacific climate and its potential to produce enhanced trends during future decades (see any number of papers from Miller, Hamlington, Merrifield, Thompson, and others).

At a minimum, this chapter should point to the map of sea-level trends from satellite altimetry over the past 30 years in Chapter 2 (Climate Trends) and note the regional differences as context for the nationwide results presented here. In addition, the Committee strongly suggests that a map of future SLR across the United States and its territories be added to demonstrate how SLR is expected to vary spatially in the future. There is additional helpful discussion in the text of Chapter 2 (Climate Trends) that could be referenced as well (see page 2-13, lines 16-17). Chapter 3 (Earth System Processes) also includes relevant information on the relationship between sea-level and natural variability (see page 3-27) that could be leveraged to support discussion of the idea and its implications for decision making and adaptation without a significant impact on the word count. In general, this chapter provides few cross-references to other physical science chapters with relevant information that could be leveraged in the coastal context to provide nuance and utility at local to regional scales.

High-Consequence, Low-Likelihood Outcomes

Chapter 9 (Coastal Effects) lacks discussion of high-consequence, low-likelihood outcomes. The possibility of such outcomes is mentioned once on page 9-4, lines 17-18, where the authors state that more than 2 meters of SLR by 2100 is possible if emissions go undeterred. This statement needs to be explicitly connected to the ITF SLR scenarios that correspond to physically plausible, high-impact outcomes (Intermediate High and High) to provide context for the high-end scenarios and connect them to use cases in supporting text for Key Message 9.3 (e.g., critical infrastructure with long design lifetimes). As a corollary, it should also be mentioned that these high-end scenarios—while physically plausible—are either low probability (*very unlikely*) or of unknown likelihood. The fact that they are low or unknown probability does not make them unimportant, as our understanding of the processes that could lead to rapid ice loss (in the West Antarctic in particular) is still evolving. The authors should incorporate the growing literature surrounding rapid ice sheet collapse in the West Antarctic (there are many papers since NCA4 to draw upon) and inform the reader about these low-likelihood, high-impact possibilities, which directly addresses the risk-based approach adopted by the draft NCA5 report.

Overlap Between Key Message 9.1 and Key Message 9.2

There is substantial overlap between Key Message 9.1 and Key Message 9.2, and the ideas covered by each key message should be more carefully organized to make Key Message 9.1 and Key Message 9.2 distinct and independently useful. Otherwise, there is no need for two separate key messages. Key Message 9.1 focuses on coastal hazards and states that ongoing SLR “will cause significant disruption to coastal residents, including damage to livelihoods, economies, infrastructure (e.g., roads, utilities, wastewater facilities), and ecosystems (*likely*,

high confidence)." Key Message 9.2 focuses on people and ecosystems and states "the combination of reduced ecosystem services and damage to the built environment from exacerbated coastal hazards will increasingly burden communities, industries, and cultures, degrading the quality of life in the coastal zone (*very likely, high confidence*)." These two statements are largely synonymous.

Examining the supporting text for Key Message 9.1, the focus is primarily on (1) the physical impact of SLR on coastal groundwater and the height, extent, and duration of flooding; and (2) the physical impact of rising sea levels coupled with extreme wave and storm events. Thus, the Committee suggests that Key Message 9.1 focus more narrowly on changes to the physical environment, with content related to human systems and ecosystems (i.e., page 9-4, lines 30-34; page 9-5, lines 10-12) moved to supporting content for Key Message 9.2. Such a reorganization would then allow the overlapping statement in Key Message 9.1 (page 9-3, lines 33-35) to be removed. The Committee also suggests that the word "hazards" be removed from Key Message 9.1, because it implies impacts to people and ecosystems, which is the focus of Key Message 9.2. A more appropriate title given the focus on SLR and the physical environment would be "Sea-Level Rise Is Altering the Coastal Zone," which is more independent from the title of Key Message 9.2.

Comments Specific to Individual Key Messages

Key Message 9.1. Coastal Hazards Are Increasing Rapidly

The severity and risks of coastal hazards across the Nation are increasing rapidly (*very likely, high confidence*), driven by accelerating sea-level rise and changing storm patterns, resulting in increased flooding, erosion, and rising groundwater tables. Over the next years, sea-level rise along the majority of US coasts is expected to be as much or greater than the observed rise in sea-level over the last 100 years (*likely, high confidence*) and will cause significant disruption to coastal residents, including damage to livelihoods, economies, infrastructure (e.g., roads, utilities, wastewater facilities), and ecosystems (*likely, high confidence*). Accounting for mounting coastal and compound hazards could inform meaningful actions to address the cascading impacts of climate change.

The chapter authors should make clear what is meant by "rapidly" in the key message title or remove this subjective word. A similar statement is made in the title for Key Message 9.2 but without the word "rapidly." Does this mean coastal hazards are increasing more rapidly than impacts to people and ecosystems? If not, remove the word "rapidly." If so, justification should be added to the traceable accounts to define the difference between rapid change and slow change.

Key Message 9.2. Coastal Impacts on People and Ecosystems Are Increasing

Climate change is already affecting the resilience of coastal ecosystems and communities (*very likely, high confidence*). Climate change and human modifications to coastal landscapes, such as seawalls, levees, and urban development, are limiting the capacity of coastal ecosystems to adapt naturally and are compounding the loss of coastal ecosystem services (*very likely, high confidence*). Without proactive strategies, the combination of reduced ecosystem services and damage to the built environment from exacerbated

coastal hazards will increasingly burden communities, industries, and cultures, degrading the quality of life in the coastal zone (*very likely, high confidence*).

Key Message 9.2 is well stated, but the overlap with Key Message 9.1 needs to be addressed as discussed above.

Key Message 9.3. Transformative Adaptation for Coastal Communities

Marginalized coastal communities are disproportionately vulnerable to the impacts of climate change and have limited resources for adaptation (*high confidence*). Maintaining cultural and economic connections within coastal communities will require transformative adaptation that addresses the interconnection between ecosystems, communities, and governance (*high confidence*). Transformative adaptation, including incremental adaptations, community co-development of adaptation strategies, nature-based solutions, and managed retreat, can equitably respond to coastal climate change impacts (*high confidence*).

Suggested title: “Transformative Adaptation Can Help Coastal Communities to Respond to Climate Change Impacts.”

The key message title should be rewritten to be a short, informative statement, consistent with the recommendation in Chapter 2 of this report. Otherwise, Key Message 9.3 is well-stated, but authors may consider replacing the term “managed retreat” in the third sentence with “community-led relocation.”

Comments on Text Supporting Key Messages

Key Message 9.1. Coastal Hazards Are Increasing Rapidly. More detail is needed within the body of text supporting Key Message 9.1 regarding how likelihood statements are connected to amounts of SLR along the CONUS coast (page 9-4, lines 13-22). For example, how is the likelihood evaluated in the statement on page 9-4, lines 13-15? If this is based on the ITF SLR scenarios (Sweet et al., 2022), then it seems this statement assumes CONUS SLR will be greater than or equal to the ITF Intermediate Low Scenario. If so, this should be stated. It should also be stated in the traceable accounts how probability of SLR being greater than or equal to the ITF Intermediate Low Scenario is calculated. Why is this statement *very likely* rather than *likely* or *virtually certain*? Presumably, this is done by comparing to the ensemble-based projections from the IPCC, but this process needs to be outlined in the traceable accounts. Do the authors base this likelihood on specific SSPs? Or degrees of warming by 2100? More explanation and detail are needed. In general, it would be preferable to base likelihood statements regarding amounts of SLR on ensemble-based IPCC projections, which can be more readily discussed using the draft NCA5 report language for both likelihood and emissions scenarios. The discrete ITF scenarios provide useful decision-relevant timelines but are not well suited for making likelihood statements.

The handling of SLR projections is inconsistent across the draft NCA5 report (see Chapter 2 of this report). The regional chapters, for example, handle SLR projections differently, with some using ITF only (e.g., Chapter 22 [Southeast]), others using IPCC only (e.g., Chapter 23 [US Caribbean]), and still others attempting to relate the two but doing so incorrectly (e.g., Chapter 28 [Southwest], Chapter 30 [Hawai‘i and US-Affiliated Pacific Islands]). Chapter 9

(Coastal Effects) is the logical place for the connection between the IPCC and ITF SLR projections to be made clear. In this vein, the Committee suggests that the ITF scenarios be explicitly discussed in the context of the IPCC scenarios and that IPCC scenarios be added to Figure 9.1 to demonstrate (a) that the IPCC and ITF SLR projections are distinct, and (b) how the two sources of information compare to each other. Figure 12.4 in NCA4 provides an example for how to present this information on a single graph.

Describing the differences and connections between the ITF and IPCC projection frameworks is important because the framings for the IPCC projections and the ITF scenarios are designed for distinct purposes. One provides a range of possible SLR amounts; the other provides distinct decision-relevant timelines. In addition, it is intended that decision makers will use NCA5 to evaluate trends and risk across climate sectors and indicators. The draft NCA5 report prescribes language for likelihood and emissions (see Front Matter) to provide consistency, which is broken by the emphasis on a set of discrete scenarios that are not only not well suited for likelihood assessment but that also have names that overlap with draft NCA5 report confidence/likelihood language for emissions scenarios (Front Matter, Table 3). For example, if a decision maker wishes to evaluate how both precipitation and sea-level will change in their location under an Intermediate scenario, then for precipitation, they would be pointed to SSP2-4.5 (per Front Matter, Table 3). For SLR, however, the same decision maker would likely focus on the ITF Intermediate SLR Scenario due to the overlapping naming conventions, which according to the ITF report (Sweet et al., 2022) is roughly the 50th percentile of the Very High (SSP5-8.5) Emissions Scenario including Low Confidence Processes. Despite both being named “Intermediate,” these represent two very different emissions pathways with very different outcomes and levels of likelihood if evaluated on a consistent basis. The unfortunate overlap in the names of SLR and emissions scenarios could lead to decision makers incorrectly weighting the risk of impacts due to SLR relative to other climate variables (such as precipitation in the example above).

The Committee recognizes that renaming the ITF SLR scenarios is not a viable solution given their wide adoption in practice, but the authors can use Chapter 9 (Coastal Effects) to clearly explain the relationships and differences between the ITF and IPCC emissions scenarios to prevent misunderstanding and misuse of the scenarios. The Committee also recognizes that there is a description of the ITF SLR Scenarios in Appendix 3 (Scenarios and Datasets), but not only is the description of the scenarios in the appendix inadequate, but it is also unlikely to be viewed by many readers. Given the apparent confusion that exists between authors across the draft NCA5 report in navigating the relationship between IPCC scenarios and ITF SLR scenarios, the Committee suggests that this information not be completely relegated to an appendix. As noted above, multiple regional chapters attempt to link ITF SLR scenarios to IPCC emissions scenarios but do so incorrectly. Thus, direct and accessible clarification is needed to assist decision makers in making accurate, well-founded assessments.

Finally, the low-likelihood, high-impact ITF SLR scenarios should be explicitly connected to the IPCC Very-High Emissions scenario (SSP5-8.5) with the low-confidence processes (e.g., marine ice-cliff instability) included. This allows the low-likelihood, high-impact scenarios to be mapped onto the NCA5 confidence/likelihood language for likelihood and allows readers to evaluate the SLR scenarios in conjunction with low-likelihood, high-impact outcomes for other climate indicators.

Key Message 9.2. Coastal Impacts on People and Ecosystems Are Increasing.

Supporting content for Key Message 9.2 is well written and includes a balanced approach that

includes broad themes and local examples. The Committee suggests the authors consider two additional items that were not covered in NCA4.

First, one of the greatest potential impacts of SLR on human systems in the United States is the disruption of the Sacramento-San Joaquin Delta. This delta sits about 50 miles inland, but the entire system is at or below sea-level and protected by 100-year-old levees that come within inches (literally) of overtopping during present-day (e.g., 2017) riverine flood events. With another foot or more of SLR, this critical delta will be flooded with seawater (some estimates are a 60% chance this century), and water supply conveyances from northern to southern California could be interrupted for as much as 18 months, devastating trillions of dollars of the economy and more than 20 million people. This is a local example, but it is one of high impact that has not been mentioned in previous reports and highlights acute risks from SLR interacting with aging critical infrastructures.

Second, the Committee suggests the chapter authors mention the interconnectedness of adaptation efforts that may deflect impacts from one community onto another. A recent study (Wang et al., 2018) used hydraulic modeling to investigate what happens when different counties around San Francisco Bay build or enhance seawalls and levees without coordinating with each other. If communities forge ahead independently with adaptation efforts, SLR impacts get shunted from one area to another (much like floods on the Mississippi get shunted to communities downstream when an upstream community builds up its levees without coordinating with the others downstream). This is an important idea to communicate to decision makers, and it intersects with environmental justice, because this mechanism could lead to communities with fewer resources being confronted with additional impacts diverted from communities with greater resources.

Key Message 9.3. Transformative Adaptation for Coastal Communities. The Committee suggests that the assessment of mitigation and adaptation approaches provide discussion of sensitivity to low-likelihood, high-impact outcomes. The approaches necessarily change under extremes SLR scenarios, and this important consideration is not addressed in the chapter. Within this context, the authors may wish to consider the assessment of flexible adaptation approaches designed to account for the deep uncertainty that characterizes SLR projections, especially those associated with processes of unknown likelihood that correspond to the highest impact outcomes. For example, the authors might discuss Dynamic Adaptive Policy Pathways (see CCB DEEP in IPCC AR6 WG2), and if these ideas are not addressed here, they should be addressed in the adaptation chapter.

Comments on Traceable Accounts

Key Message 9.1. Coastal Hazards Are Increasing Rapidly. The description of confidence and likelihood for Key Message 9.1 does not match statements of confidence and likelihood in the key message itself. For example, the key message states that it is *likely* that “sea level rise along the majority of US coasts is expected to be as much or greater than the observed rise in sea-level over the last 100 years,” but the traceable accounts states that it is *very likely* that “sea levels will rise about 10-12 inches between 2020 and 2050.” These are not analogous statements, and the same can be said for other statements in the key message compared to what is stated in the traceable accounts. The traceable accounts section is meant to directly support the key messages, and that is not done here. Therefore, either the key message or the traceable

accounts should be rewritten such that the content in the traceable accounts directly supports the statements in Key Message 9.1.

Furthermore, there needs to be more detail in the confidence and likelihood section stating which SLR scenarios are used in estimating likelihoods and how these scenarios are used to establish likelihood. One example is lines 1-2 on Page 9-19, which states, “projections show that [SLR] is expected to continue to accelerate in coming decades.” The authors should clarify under which emissions scenarios this is the case and should use the draft NCA5 report confidence/likelihood language instead of the word “expected,” which is not precisely defined by the draft NCA5 report. Another example is where the traceable accounts section states that “It is *very likely* that sea levels will rise about 10-12 inches between 2020 and 2050 based on both trajectories assessed by extrapolating rates and accelerations estimated from historical tide gauge observations and model projections.” This statement is problematic because the phrase *very likely* corresponds to a specific likelihood range of 90-100 percent (Front Matter, Table 2), but the provided range of 10-12 inches is extremely narrow for such a high likelihood. If one downloads the ITF SLR Scenarios for the United States coast,⁴ the 2020-2050 increase for the 50th percentile of each scenario can be calculated to be as follows:

- Low: 7.8 inches
- Intermediate Low: 9.1 inches
- Intermediate: 10.5 inches
- Intermediate High: 13.1 inches
- High: 15.4 inches
- Observation-based extrapolation: 10.7 inches

Assuming the chapter authors seek to base their likelihood assessments on the ITF SLR scenarios, it is unclear how one arrives at a 90-100 percent likelihood range of 10-12 inches from this set of scenarios given that the only model-based scenario that falls within the 10-12 inches range is the Intermediate scenario. Even more problematic is that according to Table 2.4 in the ITF SLR Report, there is only a 10 percent chance that CONUS SLR exceeds the Intermediate scenario for high-emission scenarios resulting in 4°C of global warming by 2100 and only a 23 percent chance for 5°C of warming. Thus, the ITF Intermediate Scenario is not a good central estimate of SLR between 2020 and 2050, and 10-12 inches is not a good estimate of the *very likely* range. The median of the observation-based extrapolation is also within that range, but it has a *likely* (not *very likely*) range of 8.8-12.6 inches, which again suggests 10-12 inches is much too narrow. More work is needed in this chapter to ensure that *all* likelihood statements in Key Message 9.1 (not just the one described above) and its associated traceable accounts are precise and map directly onto NCA5 language regarding likelihood. In cases such as these, it would be preferable to simply use the IPCC SLR projections for which likelihood statements for specific emissions scenarios can readily be made. If the NCA5 authors wish to make likelihood statements based on the ITF scenarios, then more work is needed to develop how to map the discrete ITF SLR scenarios—which are developed based on predetermined amounts of SLR in 2100, not model ensembles—onto NCA5 confidence/likelihood language.

Key Message 9.2. Coastal Impacts on People and Ecosystems Are Increasing. The confidence statements in Key Message 9.2 are reasonable, but the likelihood statements provided

⁴ See <https://sealevel.nasa.gov/task-force-scenario-tool?type=regional&subview=USA>.

in Key Message 9.2 require specific citations in traceable accounts. According to the Front Matter, the “*likelihood* of a finding is based on measures of certainty expressed probabilistically; in other words, based on statistical analysis of observed or projected results or on the authors’ expert judgment based on their assessment across scientific information sources.” Thus, in the absence of quantifiable probabilities (as is the case for statements made in Key Message 9.2), the likelihood should be based on assessment across sources. However, no sources are given in the traceable accounts to support the likelihood statements.

Key Message 9.3. Transformative Adaptation for Coastal Communities. The description of confidence and likelihood restates the statements in Key Message 9.3 and does not provide the *rationale* for the confidence statements as described in the Front Matter (page 0-10, lines 9-12). *High confidence* is attributed to all statements, but it is not stated how the confidence is derived. If the confidence is derived from the literature, sources should be provided.

Comments on Graphics and Boxes

The efficacy of graphics in this chapter is mixed. The graphics target the appropriate audiences in terms of complexity, and the general content of the figures is consistent with the content of the chapter, but the graphics fall short of communicating effectively in multiple cases.

Figure 9.1 shows projections to 2150, but there is only one mention of SLR beyond 2100 in the text, and the statement focuses on the continuation of SLR for millennia (not 2150 as depicted). The Committee suggests that the authors do one of two things. The first (and preferred) option is to add discussion of the 100-year time frame (i.e., 2125) currently depicted in the figure, which can be relevant for infrastructure investment. If this option is chosen, then the deceleration in the higher scenarios beginning at 2100 needs to be explained, as this could be confusing to some. The authors should explain whether these inflections in the rate at 2100 are due to a physical process (in which case the process should be named and described) or whether these inflections are due to the nature of the ensemble used to create the scenarios, which may or may not be homogeneous before and after 2100, as some models do not simulate the post-2100 period. The second option would be to add none of the discussion mentioned above, but in which case the post-2100 period should be excluded from the figure given the lack of discussion and context. Regardless, depicting the post-2100 period without any discussion is not recommended.

Parallel to the issue above, the caption states that “Acceleration of sea level rise in the observed record is expected to continue in all five scenarios (colored lines) through 2150.” This does not appear to be the case based on the depicted curves. The rate decreases around 2050 in the Low scenario. The rate appears approximately constant after 2100 in the Intermediate Low and Intermediate scenarios. The rate decreases around 2100 in the Intermediate High and High scenarios.

As discussed above regarding Key Message 9.1, the Committee strongly suggests that the content of Figure 9.1 be expanded to show the *likely* or *very likely* ranges of the IPCC scenarios in addition to the ITF scenarios. A good example of how to do this is Figure 12.4 in NCA4, where the *very likely* ranges spanned by the various IPCC scenarios in 2100 are provided as bars to the right of the graph. This graphical comparison is needed in NCA5 since the IPCC projection framework is used for every other climate indicator. Thus, the target audiences of NCA5 (i.e., decision makers) should be able to clearly relate the ITF sea-level projections to the SSPs used across the rest of the report. This also provides an opportunity to provide needed context for the higher-end ITF scenarios that represent low-likelihood, high-impact outcomes

associated with low-confidence, physically plausible instabilities in marine ice cliffs. The use-case for these high-end scenarios is the design of expensive and critical infrastructure with long design lifetimes, which can be referenced within the supporting text for Key Message 9.3.

Finally, the authors should be specific about which observations are used for the extrapolations mentioned in the figure caption. There are multiple sources of sea-level data, and general audiences will not know to assume that the CONUS extrapolation is produced via a technique—unspecified in the chapter or traceable accounts—that averages local sea-level observations from an unequally distributed set of tide gauges.

Figure 9.2 mixes “flooding” and “inundation” terminology. These terms have specific meanings that should be defined in the text and should not be used interchangeably unless explicitly stated.

Figure 9.2 also demonstrates a theme of this chapter review, which is that statistics aggregated over the entire United States coastline are not only inadequate indicators of current and future impacts, but they may also be detrimental to the decision-making process by overstating impacts in communities that have not yet experienced frequent flooding events and minimizing impacts in communities currently experiencing frequent events. The observed frequency of minor, moderate, and major flooding varies widely across the United States, and the same goes for projected frequencies in 2050. A key goal of this report is to be relevant for decision makers, and not addressing the regional and local differences in high-tide flooding means that this chapter falls short of that goal. At a minimum, the Committee suggests that an indicator of the range of possible event frequencies across the United States be added to each bar in the figure. Perhaps a thin vertical line could be added to the center of each bar that extends between the minimum and maximum frequency (or some percentile range) across the United States. Further improvement could be made by including three bars (plus vertical lines as described above) for each year and category—one each for east coast, west coast, and islands (Pacific and Caribbean). This would still fall short of being relevant for local decision making, but it would at least give the target audiences some indication of the importance of regional and local variation in the frequency of these events and the need to include such variability in the decision-making process.

The Committee also suggests that the authors provide at least one qualifying sentence noting why coastal communities should be concerned about “minor” flooding. Those not familiar with the terminology may not be aware of the compounding effects over time of many repeated seemingly minor events.

Figures 9.3, 9.4, and 9.5 are potentially useful summaries of concepts in the text, but the lack of effective labeling and captions limits their utility and makes them cumbersome to digest. Readers may not be able to readily connect the limited descriptions in the caption (which in the case of Figure 9.5 does not list the specific adaptation strategies depicted) to the intended components in each graphic. The Committee suggests that these figures be improved by adding relevant labels to the graphics. See Figures 28.1 and 28.6 in Chapter 28 (Southwest) for similar graphics that also include effective labeling.

Comments on Equity and Justice

Chapter 9 (Coastal Effects) provides useful discussion and review of the human dimensions of coastal change, including equity and justice issues regarding disproportionate impacts on under-resourced communities. However, discussion of these issues is weighted

toward economic disparity with less focus on the intersectionality of economics with race and other factors. The chapter could be improved by seeking out and adding references that point out the correlation between race (or other factors) and economics in at-risk coastal communities. Alternatively, the authors could cross-reference other NCA5 chapters if these ideas are discussed elsewhere.

NCA5 will be a widely viewed and referenced document, and it represents an opportunity to inject new—and less controversial or offensive—terminology into climate-related discussions and planning. The Committee suggests the chapter authors refrain from describing communities or groups of people as “marginalized,” because it perpetuates perceptions of inadequacy and lack of autonomy. The Committee suggests using terms that focus on the systemic reasons that a given community may be disproportionately impacted by climate change, such as “overburdened” or “under-resourced.” Similarly, the phrase “managed retreat” may be offensive to the people affected due to the association of the word “retreat” with giving up, while the word “managed” implies that those affected are not in control of the process. A term such as “community-led relocation” may be preferable.⁵

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible.

Other Recommended Changes

Chapter 9 (Coastal Effects) is not well integrated with the wider draft NCA5 report. There are few links to the physical-science basis chapters (Chapters 2 [Climate Trends] and 3 [Earth System Processes]), which also provide sea-level and coastal information that could be leveraged and discussed here. An overarching theme of this chapter review is the lack of regional and local information, which could be partially remedied by cross-referencing the regional chapters and focusing on providing the needed scientific and adaptation context for the regional chapters. A connection to discussions of economic impacts in the coastal zone elsewhere in the draft NCA5 report would also be welcome.

There are a couple of repeated wording issues that warrant a general statement. First, it is not clear if the terms “flooding” (typically meaning dry becoming temporarily wet) and “inundation” (typically meaning dry becoming permanently wet) are used intentionally or interchangeably. It would be preferable to define these terms to be as clear as possible and then use them consistently. Even if the chapter authors wish to use these terms interchangeably—which is not recommended—this should be explicitly stated because some in the coastal science and adaptation communities do attach specific meaning to these terms. Second, the word “already” is used often, which is (a) an ambiguous term and (b) implies that the described observation or impact is occurring prior to expectations without providing the concomitant expectations. It would be preferable to use words such as “currently” that do not link the observation or impact to unstated expectations.

⁵ See <https://eos.org/opinions/reframing-the-language-of-retreat>.

CHAPTER 10: OCEANS AND MARINE RESOURCES

Summary

This chapter summarizes the ocean changes surrounding the United States and their impacts. In general, the chapter is well written in a consistent, transparent, and credible way and at an appropriate technical level for the intended audiences. It covers a wide range of topics from economic resources to marine ecosystems. However, less discussion is included on the physical and chemical aspects of ocean changes. It may be too late in the process to make a substantial change to the content, and the content is appropriate for this report; thus, the Committee suggests a chapter title change to “Ocean Resources and Ecosystems,” which would more appropriately reflect the content of the chapter. This chapter is not about the ocean system as a whole (i.e., the connected physical, chemical, and biological system) as the title might suggest, but rather impacts on economic resources and marine ecosystems. The key findings presented are well stated and supported by the details provided. The chapter meets the requirements of Section 106 of the GCRA.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction of this chapter is generally well written but reads as an executive summary rather than an introduction. It will be helpful to provide motivation for why readers should care about issues discussed in the chapter—this includes putting the key messages into context, highlighting what is new information since NCA4, and what is not included in the chapter. The definition of ocean economy should be clearly given. For example, does ocean economy include the freshwater component (e.g., the Great Lakes)? It is also not stated what area of the ocean this chapter covers. Is it just the US exclusive economic zone? If so, this should be clarified in the introduction. The introduction should also state that changes across global oceans and their ecosystems affect the United States. References to Chapter 3 (Earth System Processes) and Chapter 17 (Climate Effects on US International Interests) would be useful.

Comments on Key Messages, Supporting Information, and Traceable Accounts

Comments on Key Messages

The key messages are generally well written, consistent, and appropriate. They reflect current understanding about observed and projected impacts to the United States; the challenges, opportunities, and success stories for addressing risk; and identification of emerging issues related to climate change. Key Message 10.1 is an excellent example of a key message that says a lot but uses mostly plain language throughout. However, the first sentence of Key Message 10.1 is confusing because coral reefs also exist in the Arctic; the chapter authors should rephrase this sentence to not compare “warm” areas of the globe (i.e., coral reefs) to “cold” parts of the globe (i.e., Arctic). There are no likelihood statements provided in the key messages. Many of the key message statements seem to be supported by quantitative evidence, and therefore

likelihood statements should also be provided in all three key messages. If there is no quantitative evidence to support the statements, this should be stated in the traceable accounts.

The text supporting the key messages is generally well written and contains sufficient details that provide further evidence. Detailed comments are provided in Appendix A.

Comments on Traceable Accounts

The traceable accounts section is well done and appropriately builds a case describing the authors' process in determining the confidence statements without introducing new concepts or conclusions. The traceable accounts would be more compelling and consistent with the framework for traceable accounts recommended in Chapter 2 of this report if the section on confidence, likelihood, and gaps included more citations.

Comments on Graphics and Boxes

The graphics are well done and are useful summations of the information in the text. They are generally effective, appropriate, and easy to interpret for the intended audiences.

Figures 10.1 and 10.2 are nice figures, but the figure captions should include source(s) and more information about how they were produced. Figure 10.1 should use lines to show that the contiguous United States, Alaska, and Hawai'i and US-Affiliated Pacific Islands are on different maps/scales. Most icons are too small to be very informative in both Figures 10.1 and 10.2.

Figure 10.5 is from the Center for American Progress. Chapter authors may consider choosing a different figure that is not from a left-leaning advocacy organization. Also, schematic figures like Figure 10.5 should have captions with some explanation of how and from where the findings in the figure were generated.

Comments on Equity and Justice

The committee suggests stronger framing of equity and justice-related issues in the introduction, as well as related dimensions of equity as relevant to oceans and marine resources. Context on historical and systemic drivers of vulnerability or disparity should be offered where appropriate.

The importance of access to knowledge and information is well addressed, as is the discussion of governance. There is mention of equity in the introduction and in the "Adaptation and Mitigation" section, but the connections in subsequent sections are not sufficiently explained. In general, issues of equity and justice are not well-developed outside of the somewhat narrow focus on disproportionate impacts to coastal Indigenous communities. It is not clear whether this is due to a lack of literature on disparate impacts of ocean change across racial and/or socioeconomic boundaries. If that is the case, it could be added as an area of uncertainty and research gap in the traceable accounts.

In Key Message 10.1, "human well-being" should be defined. In Key Message 10.2, equity and justice framing could be incorporated into benefits and burdens of impacts and adaptation measures described—who is likely to benefit and who will be left out unless intentional measures are taken?

There are opportunities to discuss where conservation efforts are most concentrated and who is benefiting the most (e.g., SLR protection measures). The text (i.e., page 10-12, lines 21-

23) should explain which communities are being more harmed by flooding and pollution. For example, more context should be given on the impact of black carbon on communities, which communities are most affected, and the structures of decision making that enable and perpetuate such harms. There are also opportunities to discuss issues related to the “not in my back yard” sentiment often associated with renewable offshore energy.

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible. Finally, specific gaps in equity- and justice-related literature with respect to the chapter focus should be noted in the text or traceable accounts.

Comments on Data and Analyses

All the results adopted from other sources and presented in this chapter seem appropriate. There is a section discussing the needs of data and the importance of data accessibility, which is helpful.

Comments on Literature Cited

Overall, appropriate literature is cited, though the use of a broader knowledge base should be explored. The literature review appears robust and mostly focused on publications since NCA4.

Other Recommended Changes

In the section on commercial fisheries (page 10-10, lines 1-24), the text implicitly blames all changes in fishery productivity on climate change, when other issues (e.g., overfishing) could also be responsible or at least have compounding effects. The text should more clearly separate these issues. Not until the third paragraph of the section is it hinted at that many of the fisheries could be overfished currently. There are already many stressors on fishery productivity (especially overfishing), which are then exacerbated by climate change.

The discussion on the importance of the ocean observing system (“Data and Research” on page 10-16) is helpful. However, the authors could expand from the narrow biological focus and highlight that observing the entire ocean system (physical, chemical, and biological aspects) using both in situ and remote sensing techniques is critical. Research cruises to assess fish stocks, and satellite missions to detect marine heat waves or phytoplankton distributions, for example, are significant and critical national investments in our collective ability to quantify and predict the impacts of climate change, which in turn determines the evolving human and policy response. NCA5 should emphasize that the nationwide environmental observing system requires continued investment. It is an essential component of the ongoing ability of the United States to track and respond to climate change.

Lastly, the text should also specify which scenarios are being referenced if they are different from the scenarios introduced in the Front Matter. Appendix A includes detailed comments on this point.

CHAPTER 11: AGRICULTURE, FOOD SYSTEMS, AND RURAL COMMUNITIES

Summary

Agriculture is a crucial component of the US economy. Agriculture is unique in that it is both a source and a sink for GHGs. At the same time, agriculture provides nutrition for a diverse population. This chapter meets the requirements of Section 106 of the GCRA, with the exception of adequate projections 25 to 100 years into the future and is written at the appropriate technical level. Given the importance of agriculture, this chapter needs to better explain the positive and negative impacts of climate change on production as it cascades up through the supply chain. The chapter focuses on growing season length, but this is not a critical challenge for agriculture. The key aspect of climate change for agriculture production is extreme events and uncertainties that impact production. The other key aspects are mitigation and adaptation strategies for both crops and livestock. The US government and the private sector are making significant investments in climate-smart practices, but the chapter does not acknowledge these investments. The chapter also discusses climate change impacts beyond the farm gate. This is important and could benefit from further discussion on impacts, mitigation, and adaptation measures. The chapter recognizes the impact of climate change on rural communities and Indigenous populations, but some additional discussion could be added.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

Overall, the introduction could provide a better road map for the rest of the chapter. The introduction cites unpredictable weather as one challenge but refers to the regional chapters as examples. Unpredictable weather is probably the most severe challenge facing agriculture production. This chapter should provide an overview of the issues, and more specific examples can be provided in the regional chapters. Shifting plant hardiness zones and growing season lengths are not the only challenges. Changes in plant hardiness zones could be seen as positives or negatives. The change in the intensity and seasonality of precipitation and temperature are a cause for concern, which should be explained. The temperature effects on plant growth stages are more severe than the annual changes in temperature. For example, early bud break on fruit trees followed by a cold snap is more damaging than longer growing seasons. The chapter rightly highlights the effect of extreme events as becoming more intense and frequent, but this is not well documented. The introduction should also state the potential synergies between mitigation and adaptation to climate change. The chapter could be more explicit about mitigation and adaptation options. Agriculture is a complex system and meets societal needs for food, fuel, and fiber. It is also a source and a sink for GHG emissions. A systems approach is needed that includes best practices and technology (e.g., breeding, precision agriculture, precision conservation, new crops). In some cases, mitigation options improve productivity and resilience.

Comments on Key Messages, Supporting Information, and Traceable Accounts

Overall, the key messages in this chapter are done well, and the key message titles that communicate a message can be used as examples in other chapters. However, there are a number of key issues that do not receive sufficient attention, and suggestions are made below of areas to emphasize. Key Message 11.1 seems like two distinct key messages and should be considered in light of feedback below.

Comments on Key Message Language and Supporting Text**Key Message 11.1. Agricultural Adaptation in an Evolving Landscape**

Climate change has increased agricultural production risks by disrupting growing zones and growing days, which are dependent on precipitation, air temperature, and soil moisture (*very likely, very high confidence*). Growing evidence for positive environmental and economic outcomes of conservation management has led to greater farmer and rancher adoption of agroecological practices (*very high confidence*) which increases the potential for agricultural producers to limit greenhouse gas emissions (*likely, medium confidence*) and improve agricultural resilience to climate change (*high confidence*).

Suggested title: “Agricultural Adaptation and Mitigation in an Evolving Landscape.”

The first part of Key Message 11.1 does not agree with the literature. Growing zones and growing degree days can be seen as positive, except crops might require additional inputs (i.e., herbicides, pesticides, and nutrients) to accommodate the additional growing period. One problem is the increased weather variability and extremes in temperature and precipitation. For example, early heat stress in April can devastate wheat crops. The Committee suggests removing Figure 11.4 on plant hardiness zones. Migration of plant hardiness zones could be a benefit, especially in the higher latitudes.

The Committee is surprised that the chapter authors chose agroecology principles to provide resilience to climate change. Some define agroecology as not utilizing technology or any synthetic inputs. The chapter needs to clearly define terms and intent. The USDA has been using the terms “climate-smart practices” or “conservation practices.” These terms are more commonly accepted within the agricultural community. US agriculture has promoted no-tillage agriculture with cover crops and crop diversity (rotations). Agroecology sometimes promotes polyculture and no chemicals. Agroecology is not the prevailing terminology in US agriculture.

This key message does not mention technologies to improve resilience and reduce inputs. Precision conservation should be discussed. For example, sensors could reduce inputs, especially nitrogen and water. Biotechnology options included deep rooted crops and changes in root architecture. The National Academies have reported on soil carbon sequestration technologies and ways to reduce emissions in agriculture (e.g., NASEM, 2019). Robotics and drones could reduce nutrients, water, pesticides, and energy inputs. The chapter would benefit from a table on technologies to reduce greenhouse emissions (i.e., N₂O and methane) and enhance soil carbon. The chapter could also relatively rank the scale of mitigation impacts. Reducing food waste and consumption also are mitigation options. The role of biofuels is not discussed especially since this is a major US policy. The evidence basis for the magnitude of mitigation provided by biofuels may be inconclusive. This could be briefly explored in this chapter, in the general text or in traceable accounts discussion.

Water use in agriculture is an evolving issue and is complicated by climate change. For example, precipitation in the Ogallala aquifer region is expected to decrease and evapotranspiration increase. This scenario exacerbates the declining water availability in the Ogallala aquifer. Energy reduction could be realized with irrigation technologies. This issue is not confined to the Ogallala region but is also relevant to California, Florida, and other areas of US agriculture and should be mentioned.

The discussion of mitigation options for methane production in US agriculture could be expanded. The text does not give the reader a sense of the mitigation options. The text says there is much variability in production systems, but the reader is not provided with any solutions. The text should provide some citations for cell-cultured meat instead of just mentioning it. The data source presented in Figure 11.10 is for global production, not US production, which should be lower.

It is surprising that the chapter does not mention any USDA programs except for the Conservation Reserve Program and Environmental Quality Incentives Program. The current administration has spent more than \$2 billion on climate-smart commodities, released last April 2021. The chapter should mention this investment in potential climate reductions for US agriculture. Both government programs and private sector investments are being made in US agriculture for climate-smart practices and ecosystem services, including carbon sequestration, which should be mentioned.

There has been an increase in wildfires in the Great Plains, which is mentioned in several regional chapters. There is no mention of wildfires and their effect on grazing land systems. As an example, a wildfire outbreak in Kansas in December 2021 burned more than 163,000 acres (66,000 ha) in portions of western and central Kansas, resulting in two deaths and more than 42 structures destroyed. The windstorm and wildfires caused more than \$2.3 million in damages, and many cattle were lost from the fires.

Drought and heat also affect livestock. The chapter could mention the effect of extended drought and its impact on animal agriculture. In the past decade, several droughts have occurred, and cattle had to be moved from the Southern Great Plains to the Northern Great Plains. This affected production and transportation costs. There was a connection to the reduction in the cattle herd, and meat prices could be used as a case study or an example. This is an example where one part of the United States impacted by climate change affects the production of the entire United States. There was an instance in the spring of 2022 where several thousand head of cattle died because of an early heat wave.

Lastly, there are cases where climate change is positive. In the Northern Great Plains, warmer temperatures have allowed for planting higher-value grain crops such as corn.

Key Message 11.2. Climate Change Disrupts Our Food Systems in Uneven Ways

Climate change is projected to reduce the availability and affordability of nutritious food (*likely, medium confidence*). These risks to food security create social and economic challenges, some of which are distributed unevenly, including worsening heat stress among farmworkers (*high confidence*) and increasing food prices (*medium confidence*). Climate change has disrupted the ability of subsistence-based people to obtain food through hunting, fishing, and foraging (*high confidence*).

This key message is reasonable. However, with current technology and agricultural adaptation, the United States has not seen a change in availability and affordability of food. This is also mentioned in the traceable accounts. The question is how adaptable US agriculture is across the different states.

Key Message 11.3. Rural Communities Face Challenges and Opportunities

Rural communities steward much of the Nation's land and natural resources, which provide food, bioproducts, and ecosystem services (*high confidence*). These crucial roles are at risk as climate change compounds existing stressors such as poverty, unemployment, and depopulation (*medium confidence*). Opportunities exist for rural communities to increase their resilience to climate change and protect rural livelihoods (*high confidence*).

The discussion on rural community resilience is useful for this chapter. However, the space devoted to explaining the Baseline Resilience Indicators for Communities (BRIC) Index is not helpful and could be included in Chapter 20 (Social Systems and Justice) because many of the BRIC principles do not apply to this particular chapter. The Committee suggests reducing the explanation of BRIC, which would allow more space to be devoted to climate variability and the impact on agricultural production and food systems.

Comments on Traceable Accounts

In general, the traceable accounts for Key Messages 11.2 and 11.3 are well supported and described.

Production constraints induced by climate affect distribution across the United States. In the traceable accounts section, the authors describe the process by which they decided to minimize the discussion on production and focus on food systems. The authors could provide examples where climate disasters have shifted production from one area of the country to another if they want to discuss the supply chain.

In the traceable account for Key Message 11.1, the authors cite literature that supports the evidence for increased variability and vulnerability. They also provide citations for technological solutions. However, in the main text, technology such as digital agriculture, information technology, and other options is not discussed as an adaptation or a mitigation tool. New citations should not be introduced in the traceable account; instead, the literature in the main body should be used as supporting evidence. The citations provided for adopting practices are focused on conservation, not agroecological practices discussed in the text. There is a disconnect between the terminology that uses agroecology and the more commonly used language within conservation agriculture, climate-smart agriculture, or other terms in current US agriculture. The Committee does not believe the authors use agroecology incorrectly but suggests that the authors improve and focus its discussion by using the terminology and conceptual framework of climate smart agriculture. This terminology is more current and specifically focused on climate mitigation and adaptation, while agroecology is a general technical framework concerning broad environmental management of agricultural production systems incorporating ecological concepts.

Comments on Graphics and Boxes

Figure 11.3 is not the first figure of ecosystem services in the draft NCA5 report. Consider cross referencing with other chapters to use one model consistently throughout NCA5 or present the concept of ecosystem services in Chapter 1 (Overview) and reference back to it.

In Figure 11.4, the plant hardiness zone does not represent the impact of climate change. Graphs illustrating weather extremes would be more appropriate, such as a change in precipitation intensity and increased rangeland wildfires (e.g., figures from the National Oceanic and Atmospheric Administration [NOAA] showing the change in the intensity and aerial extent of droughts). This figure should either include Alaska, Hawai‘i, and the US Caribbean or explain why they are missing in the caption. In addition, please include in the caption which scenario is being used for this projection.

In general, the figure captions should be longer throughout this chapter to ensure that figures are self-contained. Also, schematic figures like Figure 11.5 should have captions with some indication of how/where the findings in the figure were generated.

Regarding Figure 11.6, agroecology is not the most commonly used terminology, as described above. Agroecology principles are more associated with small-holding farming and eliminating technological inputs. A similar illustration could be used for climate-smart agriculture or regenerative agriculture. In the current figure, the text on top of the photo is difficult to reach; consider adding shading behind the text so it stands out more.

Figure 11.7 is not available for the Committee to comment on, although it might be better to use a figure from a scientific publication rather than from the American Farm Bureau.

The caption of Figure 11.8 does not incorporate all the elements in the figure. Rather than only showing incorporating perennial production into the landscape, a full menu of climate-smart practices or regenerative agriculture would make a better illustration.

Figure 11.9 is relatively basic and does not capture the variety of livestock production. There should be a separation between types of livestock. For example, beef and dairy produce more methane than hogs or chickens. This figure lumps livestock as one single unit. This figure also does not illustrate the avenues for adaptation or mitigation.

The source for Figure 11.10 is global agriculture and not the United States. The US livestock emissions should be much lower than the global emissions. This graph could be very useful if it were put in the US context.

Figure 11.14 is important because it shows the GHG emissions along the food supply chain. This figure could be used to discuss mitigation options through the food supply chain in the text.

The discussion of considerable spatial variability in resilience to natural hazards in Figures 11.15 and 11.16 is essential to policy and planning decisions. However, it may be worth discussing the placement of these figures with the authors of Chapter 20 (Social Systems and Justice).

Comments on Equity and Justice

The committee suggests stronger framing of equity- and justice-related issues in the introduction, as well as related dimensions of equity (distribution of benefits and burdens, procedural, recognition, intergenerational equity) as relevant to agriculture, food systems, and

rural communities throughout the chapter. Context on historical and systemic drivers of vulnerability or disparity should be offered where appropriate.

Specifically, this chapter should note connections to structural factors that drive inequitable nutritional outcomes. For instance, food deserts occur in both urban and rural areas causing the lack of availability of nutritious food. In addition, historical connections to current structures maintain inequitable agricultural support that determines who benefits and who bears the burdens, who participates, and recognizes sources of knowledge, and this should be acknowledged. The current administration has tried to compensate Black farmers with additional funding support, and this initiative should be mentioned. Climate smart agriculture could also be discussed in the context of equity, identifying benefits and burdens and their distribution, and power structures that may perpetuate inequities.

Specifically, page 11-12, line 17, should comment on the issues of data accessibility. Page 11-13, lines 26-28, should expand on concerns raised by Indigenous communities. Page 11-18, lines 6-20, should discuss children experiencing food insecurity and intergenerational impacts.

The chapter, as well as the cohesiveness of the report, will benefit from cross-referencing related equity and justice issues from other chapters when possible. Finally, specific gaps in equity- and justice-related literature with respect to the chapter focus should be noted.

Comments on Literature Cited

The chapter does not include some technological tools for climate adaptation and mitigation. Additional references would add to the discussion in this chapter (Basso, 2021; Cheng et al., 2022; Field et al., 2020; Gaffney et al., 2019; Hatfield et al., 2018; Khanna et al., 2021; Lark et al., 2022; Liu and Basso, 2020; Martinez-Feria and Basso, 2020; Martinez-Feria et al., 2022; Northrup et al., 2021; Ortiz-Bobea et al., 2019; Schulte et al., 2022; Yang et al., 2022).

Other Recommended Changes

There is no discussion of biofuels in this chapter. Many states and federal programs support biofuels, including biodiesel and ethanol production. Furthermore, the evidence basis for the magnitude of mitigation provided by biofuels may be inconclusive, and this could be briefly explored in this chapter, in the general text or in traceable accounts discussion. In addition to ethanol production from corn, the byproduct is distillers' grain, which can then be used for livestock feed. This is a major contribution of agriculture to substituting fossil fuels for renewable energy and should be mentioned.

Another consideration is the dual purpose of agriculture production with wind or solar production. Much of the central United States has wind production on agricultural landscapes. There was one statement on agrivoltaics, but no citations were provided.

Finally, there is no discussion on reducing food waste and loss. If the chapter will focus on the food system as noted in the traceable accounts, then reducing food waste should be discussed because it would reduce GHG emissions and production inputs.

CHAPTER 12: BUILT ENVIRONMENT, URBAN SYSTEMS, AND CITIES

Summary

Chapter 12 (Built Environment, Urban Systems, and Cities) adequately addresses the requirements of Section 106 of the GCRA, with the exception of providing projections 100 years into the future. The introduction is clear and compelling, but overall, the chapter is very technical, and, in many instances, specific themes should be rephrased for accessibility so that all sections are digestible and of interest to the broadest possible audiences.

The key messages and supporting text are well written, and sufficiently supported by the subsequent text, but the Committee suggests that text of the key messages be reordered and, in some instances, rephrased in a succinct way for readability. It is likely that language lacking in other chapters is consistently used in this chapter. The findings in this chapter are mostly clear, concise, consistent, and supported by credible, timely research. A broad number of resources are used and referenced, with some exceptions, including Table 12.1 where the Committee encourages additional citations be included.

Overall, this chapter is balanced, informative, and well referenced. However, and most critically, there should be a clearer definition of the built environment explicitly stated in the introduction that aligns with the focus of the chapter. As written, this chapter focuses on urban areas and cities, and cities and built environment are used interchangeably throughout this chapter. The chapter authors should consider either focusing on urban/cities more explicitly or having a more balanced approach to describing built environments that are not urban/cities. There is also an opportunity in this chapter to highlight built environments like the wildland-urban interface, which could reference Chapter 7 (Forests), or emphasize additional built environment systems like, stormwater. These additions may help frame topics that are or are not being covered within the chapter. Either way, the Committee suggests expanding the discussion on non-urban areas as well as referencing the intersectionality between rural and urban areas. The Committee also suggests, where appropriate, cross-referencing other chapters to both highlight the interconnected nature of topics across the report, as well as to help the chapter expand on themes without increasing the word count significantly.

Review Comments Related to the Statement of Task

Comments on Chapter Introduction

The introduction is an opportunity to focus on readability for broad audiences. As currently written, the introduction is not as compelling as it could be, nor does it provide the relevant context or background to support the key messages. Using language like “recent science highlights” is passive and lacks urgency. The chapter authors should consider revising the introduction to clearly define the built environment so that it aligns with the focus of the chapter and introduce the key messages that are the focus of subsequent sections. Specifically, Key Message 12.2 says, “Climate impacts create negative and cascading effects on the built environment, with many systems either projected or observed to be at risk of failing.” The Committee suggests using this key message as an example for clear and accessible language that should be used throughout the chapter. Additionally, the second paragraph of the introduction

presents one of many opportunities to link to other chapters including Chapters 5 (Energy Supply, Delivery, and Demand), 6 (Land Cover and Land-Use Change), 7 (Forests) 18 (Sector Interactions, Multiple Stressors, and Complex Systems), 31 (Adaptation), and 32 (Mitigation). Furthermore, the wildland-urban interface is an important facet of urban changes with climate related aspects such as increase wildfire, so the Committee suggests better integration with Chapters 7 (Forests) and 8 (Ecosystems, Ecosystem Services, and Biodiversity).

Comments on Key Messages, Supporting Information, and Traceable Accounts

Overall, key message titles are written as general labels. Aligned with the recommendation in Chapter 2 in this report, the Committee suggests chapter authors consider providing titles that are more declarative, written as short, informative statements. Rewriting titles as such will make the key messages more effective and impactful. Some of the key messages could also use additional clarification as to their relationship to the definition of built environment, urban systems, and cities, as these topics are not as interchangeable as this chapter suggests. The assessments of confidence and likelihood are communicated effectively and correspond with a strong traceable accounts section. The text supporting the key messages is communicated effectively, except for some line edit suggestions in Appendix A.

Comments on Specific Key Message Language

Key Message 12.1. Urban Areas as Drivers and Centers of Climate Change

Consumption of food, energy, and materials in urban areas is a driver of global climate change (*likely, high confidence*). Changes in land use, development, and human settlement patterns have driven and will continue to drive local and regional climate change in and near urban areas (*virtually certain, high confidence*).

Suggested title: “Urban Areas Are Drivers of and Centers for Climate Change Impacts.”

Key Message 12.2. Key Climate Impacts, Risks, and Vulnerabilities in the Built Environment

Climate change is already amplifying existing loads on the built environment and is burdening urban communities, and these impacts will intensify over the next decades (*virtually certain, high confidence*). Cities concentrate risks given current levels of infrastructure deficits, unequal exposure of people and assets, and high levels of socioeconomic inequalities (*virtually certain, high confidence*).

Suggested title: “Attributes of the Built Environment Create Climate Impacts, Risks, and Vulnerabilities.”

Key Message 12.3. Urban Climate Mitigation and Adaptation Opportunities

Cities across the United States are mitigating greenhouse gas emissions and adapting to adverse climate impacts (*likely, high confidence*). Although some states and cities are integrating climate considerations into relevant codes, standards, and policies, the pace, scale, and scope of action are not yet sufficient given the magnitude of observed and projected climate changes (*virtually certain, high confidence*).

Suggested title: “Urban Environments Create Opportunities for Climate Mitigation and Adaptation Measures.”

Key Message 12.4. Fairness in Urban Climate Governance

Urban plans show varying progress in considering who benefits or bears the burden of climate investment and efforts (*very likely, high confidence*). The emergence of local and community-led approaches—coupled with increasing collaboration among city, tribal, state, and federal governments—delineates a shift toward inclusive planning and implementation (*likely, high confidence*).

Suggested title: “Equitable Climate Investments and Planning by Communities Are Important.”

Comments on Text Supporting the Key Messages

Key Message 12.1. Urban Areas as Drivers and Centers of Climate Change. This section appropriately identifies the challenges, opportunities, and success stories with a range of broad examples, though the Committee suggests also including more specific examples that would be more compelling. Specifically, resource consumption and land use impacts will drive local and regional climate change. The Committee suggests including specific information on the impacts of pavements or traditional roofs versus interventions like cool streets, cool roofs, or green stormwater infrastructure, or including urban areas examples. This key message is very important, and the lack of examples is a missed opportunity.

Key Message 12.2. Key Climate Impacts, Risks, and Vulnerabilities in the Built Environment. This section appropriately identifies the challenges, opportunities, and success stories with a range of broad examples, though the Committee suggests also including more specific examples as they would be more compelling. Cities concentrate risks that are amplified by infrastructure deficits, unequal exposure, and inequality. The Committee appreciates the discussion of the perilous state of US infrastructure, which will require unprecedented investment. The Committee suggests elaborating on the opportunity for infrastructure investment and climate change response as mitigation and adaptation responses.

Key Message 12.3. Urban Climate Mitigation and Adaptation Opportunities. This section appropriately identifies the challenges, opportunities, and success stories with a range of broad examples, though the Committee suggests also including more specific examples as they would be more compelling.

Key Message 12.4. Fairness in Urban Climate Governance. This section appropriately identifies the challenges, opportunities, and success stories with a range of broad examples, though the Committee suggests also including more specific examples as they would be more compelling. However, the Committee suggests revising the first full paragraph on page 12-19, lines 3-12. While overall this section is well done, there are some outstanding questions that are not addressed in relation to “Fairness in Urban Climate Governance.” For example, who pays and who benefits? Additionally, this section could use graphics and perhaps a memorable concrete example.

Comments on Traceable Accounts

The traceable accounts are clear and provide sufficient context for the embedded text that reflects the current understanding of the state of the science. Specifically, the traceable accounts adequately explain the basis for confidence/likelihood assignments. However, at the beginning of the traceable accounts, the authors identify eight topical areas for the literature search. These areas may have been prescribed, but if they were not, the Committee suggests not listing urban social equity and justice as last, so as not to have it appear as an afterthought.

Comments on Graphics and Boxes

Some of the images and graphics for this section were not available to the Committee to review. Many of the maps and graphics provided are sufficient, and the Committee commends the authors for these self-contained figures that have good captions that describe both the data sources used as well as what is missing. However, many of the graphics chosen for this chapter do not add to the narrative. The Committee suggests focusing on updating Table 12.1 as detailed below and to consider removing or replacing Figures 12.6 and 12.7.

Figure 12.1 documents emissions across the United States and how this largely reflects patterns of human habitation, but the data included are from 2015. If available, the Committee suggests using updated data to create this figure. Additionally, authors should consider adding boxes around the parts of the map that show that it is at different scales/locations, and boxes that “zoom in” on a particular region(s) of interest. Also, the caption should cite more precisely the data sources, and clear labels would also be helpful.

Figure 12.2 is a useful idea, but at a nationwide scale, lacks the details to be useful. The Committee suggests focusing on an area that is predicted to have rapid change.

Figure 12.3 categorizes many land-uses into five typologies. However, the graphics could be improved, and it may be helpful to reevaluate which cities are highlighted in the heavy industry section. Additionally, the Committee suggests explaining what different impacts these building types might have on urban climate and temperatures in the caption.

Figure 12.5 has not yet cleared copyright, but it should reflect the day and night heat differences and why these are important. Additionally, the figure caption should clarify the links between the urban heat island effect (which itself is not directly caused by climate change per se) and climate change.

Figure 12.6 highlights the important correlation between local heat increases and median household income declines. However, the complexity of the graphic might be lost on broad audiences. The Committee suggests simplifying the caption to make the figure more accessible. Also, if there is no particular order for the maps, the Committee suggests alphabetical order.

Figure 12.7 is ineffective and is unlikely to inform the public or policy makers. The Committee suggests removing this figure or replacing it with a specific example. If kept, the figure should include additional examples to make it more relevant.

Figure 12.8 captures Table 12.2 well; however, it is difficult to read. The Committee suggests enlarging the graphic and moving the legend on the bottom of the figure so that the icons can also be enlarged.

Table 12.1 provides examples of climate risks to the built environment and projected losses to 2090. This is very ambitious in scope for economic losses in 2090. The Committee is unsure whether the precise numbers for 68 years from now are useful or realistic because dollar